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TRAVELS ON THE BOUNDARIES OF BOLIVIA AND PERU.*

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The travels in South America, the archæological and ethnographical results of which I am about to describe, were undertaken by Dr. Nils Holmgren (a zoologist) and myself during 1904 and the early part of 1905. In the start of the expedition Mr. D. de Bildt, one of our generous patrons, also took part. The field of our researches was the Peruvian-Bolivian plateau, previously visited by many investigators, lying north, south, and east of Lake Titicaca, and, above all, the eastern slopes of the Andes in the direction of the primeval forests between Rio Madre de Dios and Rio Beni, *i.e.* the province of Caupolican in Bolivia, at this spot known by Evans's † investigations, and the Peruvian provinces of Sandia and Caravaya, where researches were first carried on scientifically by Sir Clements Markham. ‡ Among other scientists who have visited this part of the boundary between Peru and Bolivia previously to our doing so, let me first of all mention Raimondi § and Bandelier, ‖ as also the Bolivian and Peruvian travellers, *e.g.* Pando, ¶ Stiglich, ** Cipriani, ** etc.

* Read at the Royal Geographical Society, February 26, 1906.

† Evans, "Expedition to Caupolican, Bolivia, 1901-1902," the *Geographical Journal*, vol. 22, 1903.

‡ Markham, "The Province of Carabaya, in Southern Peru," the *Journal of the R.G.S.*, vol. 31, 1861. Markham, 'A List of the Tribes in the Valley of the Amazon, including those on the Banks of the Main Stream and of all its Tributaries.' Second edition. London: 1895.

§ Raimondi, "On the rivers San Gaban and Ayapata in the Province of Carabaya, Peru," *Journal of the R.G.S.*, vol. 37, 1867. Raimondi, 'El Peru.' Lima: 1874-1880.

‖ Bandelier, "On the Relative Antiquity of Ancient Peruvian Burials," *Bull. Amer. Mus. Nat. Hist.*, vol. 20. New York: 1904.

¶ Colonel George Earl Church, "Northern Bolivia and President Pando's New Map," the *Geographical Journal*, vol. 18, 1901.

** 'Vias del Pacifico al Madre de Dios.' Publicación de la junta de vias fluviales. Lima: 1903.

Most of them having devoted their energies to other branches of science, previous to our investigations very little had been known of the ethnology of the regions in question.

It is but natural that on the eastern slopes of the Andes we experienced the utmost variations of temperature and scenery, being at times in the regions of eternal snow, and again in the tropical primeval forests, where indiarubber trees are plentiful. Moreover, as the declivity of the Andes is very abrupt towards the east, the distance between the snow-line and the forests where indiarubber is obtained, or the most sensitive tropical plants can be cultivated, is often but 50 to 60 miles. In some valleys it is possible, if mounted on a good steed, to plunge through snow on the one day, and on the next to pluck papaya or tap the rubber tree.

The Bolivian-Peruvian plateau round Lake Titicaca is inhabited by Aymara and Quichua Indians—the former south, east, and west of this lake; the latter north thereof. To the east of Lake Titicaca we passed the "language boundary" at Cojata; west of the lake, it was at the town of Puno.

The mountain valleys on the eastern slopes of the Andes have a population speaking Quichua, among which, on the fringes of the primeval forests east of the Bolivian province Caupolican, we came across some few Apolistas speaking Lapachu, Rica-Rica-speaking Lecos, and Tacana-speaking Ydiamas. These tribes are, however, completely losing their own languages, which are superseded by Quichua. It was only with the greatest difficulty that I could obtain words and phrases of the Lapachu or Lapa-Lapa language, which is at present only spoken by elderly persons.

Farther east, towards the interior of the primeval forests on Tambopata, a tributary of Rio Madre de Dios, we met a small Tacana-speaking tribe, the Tambopata-Guarayo, and visited them. Other Indians live on the shores of the same river, but, as they were very shy, we did not succeed in coming in touch with them. On Rio Inambari the Pano-speaking Yamiaca live, as also the Tuyoneiri; the last mentioned speak a language which I cannot place. Between Rio Inambari and Tambopata there is another very small Pano-speaking tribe, the Atsahuaca; coming as I did from the Yamaica Indians, I was the very first white man that visited them. On Rio Marcapata, probably a tributary of Rio Inambari, there are some Indians speaking Tacana, who call themselves Arasa; north-east of them the Huachipairi Indians are settled. The Tuyoneiri, Arasa, and Huachipairi Indians were not visited by us; I have, however, succeeded in making a collection of words from the languages of the first two of these tribes, as I have come across members of the tribes at other places.

The Aymaras and Quichuas, *i.e.* the Indians of the plateau, fells, and mountain valleys, are all Christians, being, of course, in many other

respects under the influence of Spanish civilization, though simultaneously they have retained many customs (either unchanged or modified) from the pre-Spanish period, when they exhibited a purely Indian civilization, which was the most remarkable of any at that time existing in South America. The Apolistas, Lecos, and some Tacana-speaking Indians nowadays are not easily distinguishable from the adjacent Quichua Indians, or those Quichuas actually living with them.

The Yamiaca, Guarayo, and Atsahuaca, etc., or those small tribes that inhabit the primeval forests of Rio Inambari and Rio Tambopata, live, or at any rate a year or two ago lived, in the Stone Age almost entirely unaffected by the civilization of either the Indians of the mountain valleys or that of the whites. That we could find Indians so utterly untouched by civilization so close to the Andes and near tracts known since their early conquest, is solely owing to the difficulty of penetrating the primeval forests, as also that those rivers which flow from the Andes to the primeval forests in the beginning of their course through the latter are not navigable. We thus see that the district I visited is a borderland, not only as regards nature itself, but also with respect to man.

Without touching on the more well-known plateau, I will divide my paper into three parts—first dealing with the Quichua-speaking Indians on the eastern slopes of the Andes; then our archæological researches both in the mountain valleys and the primeval forests; and, lastly, the savages of the primeval forests.

When studying the Quichua-speaking Indians, I specially devoted my attention to the economic conditions under which they live, and the customs they have retained from the period previous to the Spanish invasion. All the Quichua-speaking Indians on the eastern slopes of the Andes are agriculturists. The plants cultivated in the higher colder valleys or in the lower warmer ones are, of course, very different. In the Corani valley, for instance, which is 3985 metres (13,074 feet) above sea-level, various kinds of potatoes, oca (*Oxalis tuberosa*), broad beans, quinua (*Chenopodium quinua*) and cañagua (*Chenopodium*, cañagua), papa lisa (*Ullucos tuberosus*), and barley are all cultivated. In the Queara valley, 3460 metres (11,352 feet) above sea-level, besides all these, we met with both maize and a few garden plants. At Mojos, 1617 metres (5305 feet) above sea-level, the Indians have bananas, coffee, the sugar-cane, yucca, rice, mani, racacha (*Arracacha esculenta*), hualusa (*Colocasia esculenta*), oranges, lemons, maize, aji, tomatoes, coca, sweet potatoes, cotton, etc. Naturally each Indian does not cultivate all these plants; the most indispensable are bananas, coffee, the sugar-cane, yucca, coca, rice, and maize. Frequently the Indians of the higher mountain valleys not only have fields there, but also on the verge of the great primeval forest district in the east; for instance, the Indians of the elevated Chia valley, where only potatoes, oca,

quinua, cañagua, broad beans, and barley can be cultivated, possess fields in the vicinity of Rio Sangaban, there cultivating coca, maize, etc.

The fields are tilled in a very primitive manner. In order to loosen the soil, hoes are in use which, though nowadays provided with blades of iron, are in shape the same as those first made of bronze. The fields are seldom manured, whereas a rotation of crops is extensively used. In the mountain valleys the fields lie in neat terraces; farther towards the interior, clearings are made in the bamboo thicket or in the forest. In days of yore, when only bronze or stone implements were available, this method of clearing was no easy matter, as even with iron axes a good deal of labour is required to break a field in the primeval forest. These forests are a great obstacle to the agricultural Indian of the fell, used as he is to the fell valleys that are so easily cleared.

In the higher valleys of the fells the Quichua-speaking Indians are cattle-keepers, having alpacas, llamas, sheep, cows, small pony-like horses, donkeys, and mules. During the time of the missions, according to Armentia,* the more tropical grass-grown heights at Mojos, Pata, and Santa Cruz, etc., were well supplied with cattle, but these golden days are long since past. Farther in, towards the primeval forests no cattle-keeping can be carried on, as, in spite of the luxuriant vegetation, good pasturage is very scarce, while the animals are destroyed by the insects and vampires. The fact that the Indians of the fell are cattle-keepers is one of the chief reasons why they do not settle—except very occasionally—farther within the primeval forests.

Besides agriculture and cattle-keeping, the Indians of the fell earn their livelihood by working for the whites, more especially by tapping rubber in the primeval forests. A secondary source of income of but small importance is washing for gold, this being undertaken by Indians at Juan del Oro and at Rio Inambari in Peru. While it is true that in the provinces of Caravaya and Sandia, in Peru, a good deal of gold has been found—above all, by a North American company working a mine between Rio Inambari and Rio Tambopata with much success—it is also a fact that the importance of these finds has been much exaggerated. The trade in rubber, should good roads be constructed, may prove of vast importance; the days of cinchona are now past.

The Indians of the fells import very few necessaries from outside their own domain; some pottery and bronze pins from the Indians of the plateau, colours and a few implements from the whites, that is all. They might live very happily if they were not addicted to certain vices, chiefly insobriety, and were not oppressed by many white parasites living at their expense. By the aid of "fire-water" these cheat the Indians of the product of their agriculture and cattle-keeping, and by

* Armentia, 'Relación Historica de las misiones Franciscanas de Apolobamba.' La Paz: 1903.

means of strong drink they lure the Indians to the indiarubber barracks for the purpose of tapping rubber. The most usual method is giving the Indians the intoxicant, either on credit, or during some great dance to lend them money with which to buy the wretched stuff. When the festivity and intoxication are past, the Indians cannot pay their debt, running as it does at a high rate of interest, but are forced to enter some indiarubber barracks. Once they are there, by various tricks it is arranged that the Indians remain in debt to their master.

The Governments of Peru and Bolivia, being now recruited from patriotic men who are deeply interested in the future of these districts, really ought to interfere and protect the Indian from both "fire-water" and the oppression of the white man. They would then, on the Andes, call into being a happy population of intelligent, industrious small farmers of the chaste Quichua race, for what I have just expressed applies certainly not only to the small and limited district I visited, but also to large portions of the Andes.

In direct opposition to the Indians of the primeval forest, the fell, Indians show great possibilities of development. Both Peru and Bolivia would in this manner solve the question of immigration far better than by importing Chinese, and the inferior elements among European emigrants.

The Quichuas still practise several customs which remain, more or or less modified, from the pre-Spanish period. Among these we must reckon their dances, which are always performed in connection with religious, *i.e.* Roman Catholic festivals. Among other festivals I have witnessed, there is the festival of the Cross (La fiesta de la Cruz). The crosses on the heights and in or near churches were hung with flowers, and in the huts crosses decked with flowers were set up. In some huts I saw two crosses, one larger than the other, representing a male and female cross. Among the very peculiar customs at this festivity, let me mention two paper lanterns which were taken to the cross by night, the one shaped like the sun, the other in form like the moon. The sun is carried by a man, the moon by a woman. As we know, the Incas worshipped the sun and moon, the sun being the male, the moon the female divinity. It is only the men who take any part in this dance, as in most purely Indian dances. In Pelechuco the dancers at the Easter festivities had large feather ornaments in the form of suns on their heads (Fig. 1). At these dances both "fire-water" and chicha (ale made from maize) are drunk to excess.

Even now the dead Christian Quichua Indian takes with him his worldly possessions when departing to another sphere. This is accomplished by there first being a regular drinking-bout for a full week after a death, and then the things deemed necessary for the deceased's future state, *e.g.* tools, food, clothes, and, as a matter of course, "fire-water," are taken to an open place, where they are all burnt.

Presumably the Indians imagine they succeed in freeing the souls of these objects by this means, so that they can accompany their master. In Pelechuco these sacrifices were offered by night outside the consecrated churchyard where the dead Indian (man or woman) had been buried. The corpses themselves are never burnt.

Should the Quichua Indian build a new hut, he buries the fœtus of a llama, coca, tin figures, etc., underneath it. This is to bring luck. According to Bandelier,* during the pre-Spanish period, the

FIG. 1.—QUICHUA INDIANS DANCING AT THE EASTER FESTIVITIES WITH LARGE FEATHER ORNAMENTS IN THE FORM OF SUNS ON THEIR HEADS.

natives on the Peruvian coast, when building palaces or similar buildings, gave their walls a core formed of objects, some of which were of metal. The most valuable treasures found in Peru are said to have been obtained from such cores. The above-mentioned custom of burying objects when erecting huts is apparently a survival of this usage.

* Frederick Webb Hodge, "Bandelier's Researches in Perú and Bolivia," *American Anthropologist*, 1897.

If the Quichua Indian erects a mill in order to grind the sugar-cane, under the central post he buries the fœtus of a llama, laden with small jars of wine, fire-water, and chicha. Should the Quichua Indian desire a drought, he takes the cranium out of a modern, *i.e.* Christian Indian, grave, and sets it on a pole. Sometimes the skull is again buried, but very often it is allowed to moulder above ground. This peculiar custom may perhaps explain the headless graves described by Ten Kate,* as found among the so-called Calchaquies of Argentina. The Quichuas have very peculiar ideas concerning diseases. Should they wish a certain individual to fall ill, they place a small quantity of that person's hair, or something similar, in an ancient grave. Moreover, on all possible occasions the Indians offer up coca and fire-water; on many occasions when searching for archæological remains for me.

The Quichua-speaking Indians east of the Andes have very few objects of their own manufacture which possess any interest of importance. On the plateau you become accustomed to see stuffs where viscachas, birds, and llamas, etc., predominate as ornaments, but east of the Andes such stuff is rare. The high caps they wear (Fig. 2) are, however, of a certain interest, as their ornaments generally are different in the various valleys. In the Queara valley you find llamas on the caps; while plants ornament on those of the Quiaca valley. These latter ornaments have a certain connection with a passion that these Indians have for flowers, since in this valley, both men and women decorate themselves with flowers, and have regular gardens containing pelargoniums, chrysanthemums, tulips, etc. In the Corani valley the Indians adorn themselves with wild flowers.

Let me now touch on my archæological excavations on the eastern slopes of the Andes. In the higher fell valleys at present inhabited by Indians speaking Quichua, I have excavated many sepulchres, so-called Chulpas, and sepulchral grottoes, collecting the objects and skeletons I found therein, carefully keeping the contents of each separate from every other find. Moreover, I have purchased various articles of bronze and stone, which the Indians now living in the fell valleys have found when breaking ground, etc. Some rock carvings and sculpture on stone have been photographed by me. Old dwelling-places have been discovered by me in the primeval forest at Buturo (670 metres, 2198 feet), where pottery and stone implements were found totally unlike those of the fell valleys.

The types of graves found east of the Andes are chulpas and sepulchral grottoes. Moreover, the former are chiefly met within that district of the Andean plateau inhabited by Aymaras, and for many reasons are

* Ten Kate, "Anthropologie des anciens habitants de la région Calchaquie," *Anale del Museo de La Plata*, 1896.

ascribed to their ancestors. As Middendorf,* by studying the names of places, having proved that these Indians were formerly far more widely spread than now, it is believed that those sepulchres met with in the Quichua-speaking districts are also derived from the Aymaras. If this is correct, the valleys of the fell in question must formerly have had an Aymara population which has been ousted by Quichua, or, what

FIG. 2.—QUICHUA INDIANS FROM SANTA ROSA WITH HIGH CAPS (WEST OF THE ANDES).

is far more probable, has adopted the Quichua language. By the way, let me observe that, as the study of the nomenclature of places is in these parts so very important, it is a great mistake to do as did the French expedition to Bolivia under de Créqui Montfort,† when on their map they call the well-known islands of Lake Titicaca by the names of French discoverers, instead of retaining the Indian names thereof.

* Middendorf, 'Die Einheimischen Sprachen Perus,' Bd. V. Leipzig: 1891.

† De Créqui Montfort and Sénéchal de la Grange, "Rapport sur une Mission scientifique en Amérique du Sud." Nouvelles Archives des Missions scientifiques, Tome 12. Paris: 1904.

Chulpas or sepulchral grottoes, or both of them, have been found by me in all the higher valleys of the fells visited by our expedition. There is no essential difference between chulpas and sepulchral grottoes, a natural grotto having often been used as a wall or roof for a sepulchre. In Pelechuco valley, where it is easy to obtain large slates, very beautiful stone sepulchres (Fig. 3) have been made thereof. In some valleys where natural grottoes are numerous, these are used as burial-places.

FIG. 3.—CHULPA PELECHUCO VALLEY.

In the Quiaca valley there is a peculiar kind of sepulchre, consisting of a massive pillar above a small sepulchral chamber. Many of the chulpas are constructed like regular miniature houses, being provided with a door (Fig. 4). These belong to a type often seen represented in travels on the plateau. The door is not directed towards any special point of the compass as a general rule. Some of the graves in the Ollachea valley are constructed on such inaccessible spots on the mountain that it is quite perilous to reach them. Several graves are of masonry. On some in the Ollachea valley, there are traces of their having been painted red.

Neither chulpas, sepulchral grottoes, nor stone or bronze implements are here found west or east of the highest chain of the Andes, above the present limit of cultivation. Not once have I made a single observation pointing at this limit being higher or lower than at present, so long as these districts have been inhabited by man. The settled population, mostly speaking Quichua, and exclusively devoted to cattle-keeping, now inhabiting the extensive plains round Cojata, Macusani, etc., lying west of the highest chain of the Andes, and above the limit of cultivation, have settled there in a period later than the time when sepulchres were erected, or bronze implements were in use. On the lower parts of the plateau, on the contrary, the Indians live both by cattle-keeping and agriculture. East of the Cordillera Real, in the higher valleys of the fell, the possibilities of human subsistence are about the same as on the plateau. On the verge of the primeval forests, as I have previously observed, far more tropical plants can be cultivated than anywhere on the plateau.

Penetrating deeper down into the valleys to the east, farther into the primeval forests, we find, as I have before stated, that it is no longer possible to carry on cattle-keeping, above all, to keep llamas, the cultured plants that can be grown being different to those that can be cultivated in the higher valleys of the fell, or on the plateau. It will also be found that you never meet with chulpas or sepulchral grottos (at any rate, not in those valleys I visited), and very rarely come across objects of bronze or pottery typical of the valleys of the fell or the plateau farther towards the interior of the primeval forests, except in those places where pasturage for llamas has existed in the vicinity, and it has been possible to cultivate those plants so characteristic of the plateau.

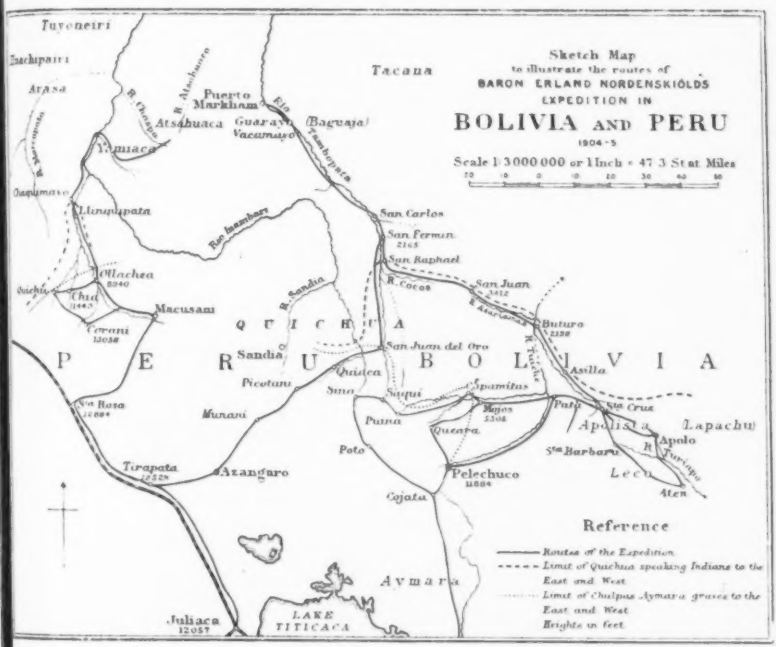
On the accompanying map the chulpa limit to the east in that district visited by me is marked. It proceeds somewhat further up the Andes than the limit of the present expansion of the Quichua-speaking Indians. The difficulty of breaking ground with the primitive implements they possess, the dread of fever and of the savage Indians of the primeval forests, have contributed to the fact that the Indians of the fell (which otherwise present so great a power of expansion) have not spread towards the interior of the exceedingly fertile districts of the primeval forests; but the chief reason has probably been their not having pasturage for their llamas, and their not being able to cultivate the same plants they were accustomed to on the fells.

In the primeval forests east of Cuzco the Indians of the fell (with the exception of some military expeditions of the Incas) have not spread. There, according to Squier,* the fortresses of Paucartambo,

* Squier, 'Peru.' New York: 1877.

Pisac, and Ollantaytambo determine the eastern boundary of the Inca rule. Their territory did not extend further than 60 miles east of their capital, Cuzco, and yet they, or, at any rate, their cultural influence, predominated from Argentina to Equador. Squier considers that the vast primeval forests and the savages hindered the Incas in their passage eastwards.

Most of the chulpas and sepulchral grottoes had been plundered previous to their being discovered by me. In the valleys of Pelechuco and Queara, however, Mr. and Mrs. Bandelier excavated several



graves, thus preserving a good deal of material from destruction. Most Quichuas of the present day were not much inclined to show me where the graves were, but made no attempt to hinder me from digging. In the Queara valley they believed that I took the skeletons in order to bring them to life in my own country, where they would either be employed as workmen—the people of my own land being weak and lazy—or would be whipped till they discovered where the Incas had their gold-mines. It is very pardonable for the Indians to think that gold always attracts the white man.

Only in a few of the graves did I find one single skeleton; most of

them contained a quantity. In one sepulchral grotto I found close upon two hundred, and in one chulpa sixteen. Those skeletons that I found entire, and that I feel convinced have never been disturbed, were always in a sitting posture. All the dead have been placed in the sepulchral chambers, not merely buried in the grave.

The chief finds of the graves are bronze pins—so called topos. They are adorned with llama heads, or have heads in the form of leaves, at times also flowers (?), or still more often simply a flat disc. Topos are

FIG. 4.—CHULPA QUIACA VALLEY.

used by the Quichua women of the present day to fasten the shawl they wear over their shoulders. The modern topos are invariably more pointed than those of ancient days. The cloths of which remains are found in the graves were so coarsely woven that blunt topos did not necessarily damage the garment. Pottery is rare. The patterns thereon are mostly diamond or spiral, painted in black, seldom in yellowish-white. In most graves, though they have certainly not been disturbed, nothing but skeletons were found. Perfectly empty sepulchres were also found; this is often owing to the skeletons having

entirely mouldered away, but at times it seems probable that the sepulchre has never been used.

Sometimes quite modern articles are found in the graves. In a grave at Quiaca, in which bronze objects had been discovered, I found not only trepanned crania, but pottery of modern Pucara manufacture, and glass bottles. On one of these bottles there stood, "Die Keisserliche Privilegirt Altonatiche W. Kronessents." They have evidently been put into the graves by the Quichua-speaking Indians at present living in the vicinity, probably in connection with the plundering of the grave. I have already mentioned the customs of placing objects in graves for the purpose of bewitching persons that are disliked. In one sepulchral grotto I found a gilded glass bead; in another, together with bronze objects, a piece of a cow-horn.

Burial in the old manner in chulpas, etc., was continued long after the conquest of the country by the Spaniards in exactly the same way as before, as also artificial deformation of the crania, etc. Bandelier,* when mentioning the attempts of the Catholic priesthood to eradicate the ancient mode of burial prevalent among the Indians, states, "Not only was the ancient mode of burial extensively practised until more than a hundred years after the first arrival of the Spaniards, but the cloth with which all the corpses (ancient and modern) were covered was periodically renewed as late as the middle of the seventeenth century. The fact that food and drink also were replaced from time to time implies that the vessels found along with the bodies are no longer those originally buried with them." Bandelier points out that as late as the close of the sixteenth century artificial deformation of the cranium was practised, since it was prohibited by the viceroy D. Francisco Toledo. It is, therefore, very difficult to decide whether what is found was really deposited in the graves at the same time as the skeleton or no when all the objects are met with superficially.

In the sepulchres incomplete articles are often found, *e.g.* handles of hoes without any blade, pestles without any mortar, pieces of pottery, etc. This must be some kind of "grave goods" for some reason or another placed in the sepulchres in this incomplete state. It cannot possibly be owing to these sepulchres having been inhabited —which, according to Bandelier,† has been the case with some chulpas —since the objects are found in this state in chulpas which cannot possibly be used even for a casual shelter over-night.

One great deficiency in my investigations of the eastern slopes of the Andes is my not having succeeded in making a single thorough

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* Bandelier, "On the Relative Antiquity of Ancient Peruvian Burials," *Bull. Amer. Mus. Nat. Hist.*, vol. 20. New York: 1904.

† 'Sinopsis Estadistica y Geográfica de la Republica de Bolivia,' Tomo 1, p. 129. La Paz: 1903. Original paper not seen.

examination of any dwelling-place in the valleys of the fell. There are a number of ruins of houses, deemed by some Indians to be of ancient date, but the finds made by me were generally very poor, and certainly belonged to different periods. In the valley of Queara there are a couple of round houses with slate roofs that are called Incahuasi, resembling large chulpas of the type I have mentioned as having a small door. At Corani there are remains of a number of houses that are also round, which, in my opinion, might belong to the chulpa period. Entrance to these houses has probably been obtained through the roof. The reason why the dwelling-places are destroyed is that the Indians do not leave them undisturbed, as is the case with the sepulchres, when making fields or gardens, etc. Most of the finds made when the Indians break ground are derived from dwelling-places that have been destroyed.

A number of bronze and stone implements found by the Indians when making similar clearings have been purchased by me. The articles of bronze are so far interesting that they prove how widely those implements, so characteristic of the civilization of the Andean fells, have spread. Axes, hoes, chisels, awls, knives, so-called "tumis," are found here that are in form almost identical with those described by Ambrosetti * as seen in North Argentina, 600 or 800 miles from these districts.

Here, as in Argentina, bronze and stone axes of a T-shape are found. One stone axe found by me shows the influence of metal technics on working in stone, as its edge is curved outwards. Similar instances are very common with us in Northern Europe from the early days of the Bronze Age, but I have not met with any mention of their having ever been discovered in South America.

In the Sina valley numerous sculptured stones are found, which may possibly be derived from some vast building. They are, for the most part, built into the walls of the church and belfry, but you come across many here and there in the village of Sina. One I found on which a jaguar was cut; another had a conventionalized head of a jaguar. This latter is a great stone that serves as a bridge over the brook of Sina. Each mule or pedestrian passing across it naturally gives the head one or several kicks, so that in a very short time the sculpture will be totally obliterated. Several stones are ornamented with serpents, while one is adorned with a fish, seen from above. These large stones with animal figures thereon are the only specimens of a highly developed stone-cutting found in this part of the eastern slopes of the Andes.

Rock paintings and carvings are rarely seen here. I must mention a grotto at Corani, lying far above the limits of cultivation

* Ambrosetti, "El bronce en la Región Calchaqui," *Anales del Museo Nacional de Buenos Aires*, tomo xi. Buenos Aires: 1904.

and chulpas, in which the wall is perfectly covered with figures (Fig. 5). To this very day the Indians offer coca there. A few crosses painted in red above a number of incised figures are probably intended to counteract the evil influence the figures may be deemed to exercise. It was probably with the same idea that a priest read prayers above the painted grottoes at Quatchichocana * in North Argentina, in order to exorcise witchcraft and evil.

This is, in brief, what I have discovered in the fell valleys east of the Andes, bearing any close connection with the civilization of the Andean fells, more especially with the builders of the chulpas, who

FIG. 5.—FROM THE CAVE AT CORANI.

were probably the ancestors of the Aymaras. *As we have ascertained, the remains of this civilization is not met with farther east than the verge of the primeval or dense tropical forests, with the sole exception of the valleys of the fell, which afford to man about the same conditions of life as the lower parts of the Bolivian-Peruvian elevated plateau round Lake Titicaca.*

Further east towards the interior of the primeval forests, in the dense tropical forests at Rio Tuiche (Buturo), 600 to 700 metres (1960 to 2300 feet) above sea-level, I found large dwelling-places. They prove that the now uninhabited primeval forests formerly had a numerous population. The things found there were absolutely unlike

* Erland Nordenskiöld, "Resa i gränstrakterna mellan Bolivia och Argentina," *Ymer*, 1902, Fig. 8, p. 451.

anything discovered in the fell valleys, and are derived from a population that has evidently occupied a higher status than the savages at present living in the primeval forests at Rio Madidi, Rio Tambopata, and Rio Inambari.

Thus in the primeval forests large grinding-stones (Fig. 6) are found, masses of fragments of pottery, furnished with totally different ornaments from those seen on the pottery from the chulpas, the ornamentation being made by the laying on of fillets of clay, whereas the ornaments on the pots from the valleys of the fell are diamond, spiral, and triangular patterns chiefly painted in black. The stone axes from the primeval forests possess a characteristic form. Human faces, modelled in clay, have also been found by me, one having the lower and the upper lip perforated, another being simply perforated through the upper.

It is no easy matter to decide from which tribe these finds from the primeval forests are derived. About 1670 it appears that a tribe Suquitunia * were living in these districts, but it is impossible to know whether these objects belonged to them or no. It seems, from the accounts of the missionaries, that the tribes speaking Tacana and Lapachu they met in these parts did not even boil their food, but simply roasted it, which statement does not agree very well with the quantity of pottery found in the primeval forests. The clay figures might possibly be those idols mentioned by the missionaries, unless, as Ehrenreich † supposes, the latter were simply dance masks.

On my former travels in Chaco, in Argentina, I also found large dwelling-places in the primeval forests beyond the real Calchaqui territory, in districts at present very sparsely inhabited. Ceramic art was in this case also of a characteristic local type.

It would be very interesting to institute researches with a view of ascertaining whether very large ranges east of the Andes, at present inhabited by more or less wandering tribes, were not formerly occupied by a settled population of far higher standing than that now dwelling there. It would also be of importance to learn in what degree these Indians of the primeval forests have possessed any independent civilization, or how far they have been influenced by that of the fell. In Chaco I found shells (*Oliva peruana*) from the Pacific in a grave ‡ which proves that communication for purposes of barter existed from the shores of the ocean to the dense tropical forests of Chaco. In the

* Armentia, 'Relación Historica de lasmisiones Franciscanas de Apolabamba.' La Paz: 1903. 'Relación y Descripción de las misiones y conversiones de infieles, Vulgarmente Llamados de Apolobamba,' etc. La Paz, 1898. Published by M. V. Ballivian.

† Ehrenreich, "Die Ethnographie Südamerikas," etc., *Archiv. für Anthropologie*, Neue Folge, Bd. 3, Heft I. Braunschweig: 1904.

‡ Erland Nordenskiöld, "Prâcolumbische Wohn- und Begrâbnisplätze an der Südwestgrenze von Chaco," *Kongl. Svenska Vetenskaps-Akademiens Handlingar*, Bd. 36, No. 7. Stockholm: 1903.

primeval forests of Rio Tuiche I found no object that can be considered derived from the Indians of the fell, but, having discovered no graves, I have been forced to content myself with investigating dwelling-places, which, as a general rule, give a poor result.

Let me now proceed to describe those forest Indians living in the immediate vicinity of the Andes and the Quichuas. As already mentioned in my introductory paragraph, of these tribes we visited the

FIG. 6.—GRINDING-STONE FROM THE FORESTS OF BUTURO.

Guarayo at Rio Tambopata, the Yamiaca at Rio Inambari, and the Atsahuaca residing between these two rivers.

It was no easy matter to go to these Indians, and perils beset our route both down the Tambopata when we followed the last unexplored portion of this river, and our march into the primeval forests between Tambopata and Inambari. However, it is not our adventures and sufferings that are to be described here, but the result obtained by our exertions.

The Quichuas and whites call the savages of the primeval forests "Chunchos." Yamiaca and Atsahuaca are tribe names or horde names

the savages also give the rivers they live on. The signification of Guarayo is, on the contrary, very complicated. It is evident that this word at times simply means "enemy," but it also appears that it is sometimes used to designate just those Indians living on Rio Tambopata, Rio Heath, or the Rio Madidi, thus Tacana-speaking savage tribes. There are no Tupi-speaking Guarayo in the forests between the Rio Madre de Dios and the Beni. It would land me far too deep in the slough of detail if I attempted to give any comprehensive explanation of the use of Guarayo* as a tribal name. Let me denominate the tribe of Indians at the Rio Tambopata as Tambopata-Guarayo, leaving to the future the choice of a better name for them.

The tribes living beside the rivers Rio Inambari and Rio Tambopata are very small in number. The Yamiaca consists of from thirty to forty individuals, the Atsahuaca of about twenty-five. Of the Tambopata-Guarayo tribe I have seen about thirty or forty, but they are far more numerous. Each tribe has its own chief; this dignity does not pass by inheritance from father to son, however, but it seems that the chief warrior of the tribe is chosen as its head. Though these tribes are so small in number, several different languages are met with in these districts, as already mentioned by me. Thus the Tambopata-Guarayo speak Tacana; the Atsahuaca and Yamiaca speak Pano; while the Tuyoneiri living near the Yamiaca speak a third language. The Yamiaca mix many Tacana words in the Pano language they speak. The Tacana-speaking peoples are not widely disseminated, their territory being between the lower Rio Madre de Dios and the Rio Beni. Some of them are christened and civilized. The person who has done most to make them known is Armentia.† The Pano-speaking peoples live on the shores of Rio Ucayali, Rio Madre de Dios, and the Rio Beni, and the intermediate district. It was de la Grasserie ‡ who first made them one group. K. v. d. Steinen § has made the most important contribution to our knowledge of this group of languages.

Peaceable communication between the tribes, as also the capture of women, naturally conduce to the confusion of languages. Wars are of very usual occurrence, being chiefly undertaken for the purpose of capturing women or plunder. It cannot be stated that the Tambopata-Guarayo, Yamiaca, and Atsahuaca Indians have carried on warfare with their nearest neighbours to the west, the Quichuas, or the whites;

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* Erland Nordenskiöld, "Beiträge zur Kenntnis einiger Indianerstämme des Rio Madre de Dios-Gebietes," *Ymer*, Heft III., 1905.

† Armentia, 'Navigación del Madre de Dios.' La Paz: 1887. Lafone Quevedo, "Arte y Vocabulario de la Lengua Tacana," *Revista del Museo de la Plata*, 1902.

‡ De la Grasserie, "De la famille linguistique Pano," Amer. Congr., p. 438. Berlin: 1888.

§ K. v. d. Steinen, 'Diccionario Sipibo.' Berlin: 1904.

there have simply been some surprises from the savages, which have scarcely led to any reprisals being taken by either the whites or the still more cowardly Quichuas. Nor have these Indians been subjected to any direct persecution by the whites on Rio Madre de Dios, but have simply had the unpleasant experience of hostile tribes penetrating closer to their territory. Their arms of warfare are the bow and arrow. They do not poison the arrow-tips. They are totally unacquainted with knives and clubs. Peaceable communication exists also between the tribes, and by this means Indians like the Atsahuaca, never previously visited by the whites, have obtained iron axes, machétes, etc.

All these Indians of the primeval forest are agriculturists, though they have no settled place of abode. They are people who till the soil, and yet are constantly ambulant. Each tribe owns fields spread over a large territory, which they visit in turn for sowing and reaping. The Yamiaca and Tambopata-Guarayo, living on the larger rivers abounding in water, move from place to place in canoes and on rafts. The Atsahuaca, living by rapid-flowing brooks, have no such craft, but, on coming to a river which they cannot wade through, they cross it by riding on a log.

The reasons why the fields often lie at a distance of several days' marches from each other are numerous. One of the chief causes has doubtless been the difficulty of finding ground that could be broken with ease. A couple of years ago all these savages were exclusively restricted to stone and bone implements, and it is not an easy matter to clear a glade in the dense tropical forests with such tools. Just for this reason the fields are invariably found in the "chucal," a kind of extremely dense bamboo thicket, where it is comparatively easy to break ground, as few large trees grow there. Another motive for these numerous fields has doubtless been that the Indians wished to have them spread over as extended fishing and hunting grounds as possible. Perhaps they also wished to have numerous fields, in case one or other was plundered by their enemies. As a rule the fields are not large, about 50 by 20 metres (164 by 65 feet) or so; but as they can break many fields in the same bamboo thicket, the entire area may be large. The largest field seen by me—it belonged to the Tambopata-Guarayo—was 150 by 75 metres (492 by 246 feet). In almost all the clearings bananas are cultivated, the plants being placed at a certain distance from each other, so that they give the impression of being planted in rows. Other plants are cultivated between them, those needing much sun, however, in fields where the banana is not grown, or the banana plants are quite small. Special care is devoted to the sugar-canes, they being fenced in and provided with supports.

Besides bananas, I have seen the following plants under cultivation: yellow and white mandioca, sweet potatoes, kalabasses, cotton, a narrow,

very palatable variety of sugar-cane, and maize. Besides these, the Tambopata-Guarayo cultivate hualusa (*Colocasia esculenta*) and tobacco, the Atsahuaca aji, and the Yamiaca the pine-apple, which is obtained from the whites. Of all these plants the banana is the most important, then mandioca and maize. The Tambopata-Guarayo do not smoke the tobacco cultivated, nor do I believe it to be chewed or taken as snuff. The fields are common property, at any rate with the Tambopata-Guarayo and Atsahuaca, but there is apparently an exception made with respect to the sugar, so delicious to them. When carried into camp, the produce of the fields becomes private property.

FIG. 7.—ATSAHUACA HUT.

These Indians support life, not only by agriculture, but also by hunting and fishing. The Yamiaca and Tambopata-Guarayo are very ardent fishers; the Atsahuaca are the best hunters. Fishing is carried on with bow and arrow. For this purpose the Yamiaca have harpoon arrows. The Tambopata-Guarayo use wooden hooks. The Yamiaca and Atsahuaca have a way of catching fish by poisoning the water with

a certain root. It would be interesting to touch upon the various types of arrow used for hunting and fishing, but would necessitate far too many details. Much labour is expended on these weapons, and, for instance, an arrow from Atsahuaca can always be distinguished from one from Tambopata-Guarayo. The spoils of hunting and fishing become common property, at any rate when any large kill or good catch is made. All these Indians own dogs; the Yamiaca have fowls they have obtained from the whites, but, as is the case with the wild birds these savages sometimes tame, they keep them, not for food, but for company.

As I have previously stated, these tribes have no settled dwelling-place, but own a number of huts at different places in the vicinity of their fields. The Tambopata-Guarayos and also the Yamiaca live in communal huts, *i.e.* several families live together in one hut, where each has its own domain and fireplace. In the Atsahuaca tribe each family inhabits a separate hut (Fig. 7). These huts are as simple as possible, the Atsahuaca contenting themselves with a protective roof of a few palm-leaves, while the Tambopata-Guarayo and Yamiaca set up an oblong round hut of the stems of an enormous reed (*Gynerium saccharioides*) stuck into the ground.

There are no large families. These Indians are monogamists, and from one to three children are seen in each family. In the very largest family I saw among these Indians—it was in the Atsahuaca tribe—there were but four children. In a portion of the hut, or in a hut of their own, each family has their fireplace, where the wood is spread fanwise, not only in order to save the fuel, but so that the members of the family may creep close to the warm wood. Fire is obtained in the usual way with wooden sticks.

The Tambopata-Guarayo have no other cooking-vessels than sections of bamboo, in which they steam their food. The Yamiaca and Atsahuaca possess crocks of a most primitive type. Among the Atsahuaca it is only the women who boil their food (K. v. d. Steinen * made a similar observation among the Bakaïri); the men invariably roast theirs. Both men and women carry in wood to the huts. Making pottery is "woman's work." The males of all these Indian tribes are clad in a shirt without sleeves, made of beaten bast or of the cotton they themselves cultivate. The females wear a square piece of the same material round their hips (Fig. 8), sometimes also wearing a similar square across their shoulders. Both men and women have the cartilage of the nose pierced, having a disc of mother-of-pearl inserted in it, or nowadays sometimes a coin. This perforation of the nasal cartilage has no connection with arriving at puberty, being undertaken long before that period. Some men also have the corners of their mouth

* K. v. d. Steinen, 'Unter den Naturvölkern Zentral Brasiliens.' Berlin: 1894.

perforated, having small wooden plugs in them for everyday occasions, but inserting feathers on high days. Among other adornments the men have frontals of gay parrots' feathers. The Atsahuaca women wear necklaces of monkeys' teeth, while with the Tambopata-Guarayo these are worn by men.

The Tambopata-Guarayo Indians paint their arms, legs, and faces red. The Atsahuaca adorn themselves with patterns in red and blue. None of these Indians are tattooed. All these Indians, in direct opposition to the Quichua, are extremely cleanly in their habits. Nevertheless, they fall a prey to various diseases. While I was with the Atsahuaca they suffered from dysentery; a woman attacked by

FIG. 8.—ATSAHUACA WOMAN AND BOY.

this disease was beaten with nettles (*Urera*, sp.) all over her naked body with a view to curing her. When this treatment had not the curative effect desired, her husband trampled on the various parts of her body, evidently with the intention of thus driving away the ailment.

These savages, more especially the Atsahuaca and Guarayo, were extremely kind and friendly towards us, built us huts, gave us fire, and presented us with different produce from their fields. The Atsahuaca offered me their most beautiful woman, Tamutsi, if only I would marry her and remain with them altogether. These savages of the primeval forest awaken much sympathy in me, though I know full well that they are doomed to extinction. The forests they live in are rich in

indiarubber, so that very soon the whites will have taken possession of every scrap of their domain. Probably I am one of the very few who have been permitted to see any of the small primitive tribes living at the base of the Andes previous to their losing all their original customs and usages. They will soon become wretched objects, tapping indiarubber trees and drinking fire-water; this is the inexorable fate to which "los terribles chunchos" are hastening with incredible speed.

Before the paper, the CHAIRMAN (Sir THOMAS HOLDICH): Baron Nordenskiöld, who is to address us to-night, is a member of a well-known geographical family. He is the son of the late Baron Adolf Nordenskiöld, who was famous as one of the most eminent geographers of the last century. It is not very long ago that we had the pleasure of hearing from his cousin, Dr. Otto Nordenskiöld, an account of Antarctic discovery. To-night the baron will take us to a part of South America which has been very little visited by white men—the eastern slopes of the Andes and those sources of the Amazon river which are buried in primeval forest. This part of the continent of South America offers many points of unusual interest, perhaps as much ethnographically as geographically, for it is undeniable that very many of the aboriginal tribes of South America are rapidly disappearing. There are tribes in the northern parts of South America, as in the south, that can now be numbered by tens which not long ago could be reckoned in thousands. It is for this reason that all the information we can obtain about them is so important. I will ask Baron Nordenskiöld to commence his address.

After the paper, the CHAIRMAN: I think we may well congratulate Baron Nordenskiöld on the excellence of his illustrations. They are most wonderfully clear, and most appropriate to the subject of his paper. We are fortunate to-night in having several gentlemen here who are more or less acquainted with the regions about which he has been telling us; amongst others the Belgian *Chargé d'affaires*, Colonel Don Pedro Suarez. I will ask him to address a few words to you.

Colonel PEDRO SUAREZ: Kindly allow me to commence by thanking Baron Nordenskiöld, in the name of the Government of Bolivia and in my own, for the interesting lecture he has just given us on his troubles on the boundaries of Bolivia and Peru. As a Bolivian, I am always very grateful to those distinguished travellers who have honoured my country with even a hurried visit, which, however, frequently does not give them sufficient time to study personally the habits and customs of the country, and to a great extent they have to rely upon information they receive, which in the majority of cases is very misleading. From my own personal knowledge and experience, both in South America and in Europe, I have acquired a thorough acquaintance with the grading and export of indiarubber and other tropical products grown in the forests and on the banks of our great rivers. Our Governments as a rule spare no efforts to protect the natives, and when abuses crop up, as they needs must in those immense regions, the Governments put a stop to them as soon as they become known. I can proudly assert, speaking on behalf of my people, that the indiarubber and other products which I have mentioned are not stained with blood, nor have they been wrung from the helpless aborigines without giving them something of fair value in exchange, as is notoriously the case with the indiarubber coming from other parts of the world.

I am sorry to disagree with Baron Nordenskiöld in reference to the photos he has just shown us of some persons supposed to be Mojos Indians, and which in no

way resemble the inhabitants of the Beni Department, which is the country of the real Mojos. Most likely the photos are of some Indians of a small village called Mojos, in the Department of La Paz, and the tribe is that of the Aimara Indians. As a member of the Bolivian Congress representing the Department of the Beni, I had occasion to investigate the reports that the Indians were robbed and ill treated on the indiarubber estates, and I only discovered three instances, two of which were by European settlers; therefore the information gathered by Baron Nordenskiöld in this respect is not quite correct.

Colonel CHURCH: The paper with which Baron Nordenskiöld has favoured us this evening is useful for purposes of comparison. The region, across the threshold of which he penetrated, is historic—the Inca Yupanqui lost a large army in it, and several expeditions which Hernan Pizarro sent to conquer it were driven back by the savages; but afterwards, during the last half of the sixteenth century and the whole of the seventeenth and eighteenth, the missionary fathers of the Mercedario convent of Cuzco, that of Moquequa, the Jesuit convent of Juli, on Lake Titicaca, and the Franciscans from La Paz penetrated to all parts of the valley of the Rio Beni and the southern portion of the basin of the Madre de Dios, and accumulated more ethnological data regarding the languages and the manners and customs, appearance and characteristics, of the savage tribes occupying the provinces of Caravaya, Caupolican, Apolobamba, and their bordering regions than has ever been collected since.

Juan Alvarez Maldonado, in his various expeditions from 1567 to 1587, did for geography what the missionaries afterwards did for ethnology: he traced the river Madre de Dios from its source to its junction with the Beni, and gave a very fair description of the south-western affluents of both of those great streams. In recent times, we all seem very fond of rediscovering what was discovered in South America centuries ago by its Spanish and Portuguese conquerors.

We delight, also, to pile up the names of savage tribes: every dirty little group or small family we call a tribe, forgetting that nine-tenths of them, at least, bear nicknames conferred on them by their scornful neighbours, or have the names of the *caciques* who lead them. Therefore tribal names are constantly changing.

In studying the tribes at present found in the region of which Baron Nordenskiöld's paper treats, account should be taken of the dislocation of aboriginal nations due to the Spanish and Portuguese invasion of South America and other causes. The Guarayos, for instance, are of Guarani stock. Their original habitat was probably the great flooded area of the upper Paraguay river; they were driven north into Chiquitos. Some of them occupied the country south of the junction of the Itonama and Mamoré rivers; but a large section probably possessed themselves of the valley of the Madidi branch of the Beni in Incarial times, and have become assimilated with the Toromonas and Araonas—Tacana tribes, a dialect of whose language they now speak.

The Chunchos are another tribe of interest. Their territory, at the date of the conquest, was the western side of the upper Beni as far north as the Tuiche river—say 14° S. lat., and east and south-east of them lay the region known to the Incas as Musu. The name *Chunchu* finally became generalized, until, in later colonial days, along the whole of the oriental frontage of Peru, it was synonymous with *savage*. Musu became Mojos, and has given its name to a vast area of north-eastern Bolivia.

During the Spanish conquest of Peru, many Quichua Indians, to escape terrible persecutions, fled down the mountains to the Beni valley; but in general they preferred to seek refuge among the Tacana tribes rather than remain with the Chunchus. The real reason why neither Inca nor Spaniard has been able to

colonize the hot valleys to the east of the Andes with Aymarás and Quichuas from the mountains, is that these races, and their favourite animal the llama, rapidly pine away and die in the lowlands.

I do not believe that there ever was developed even an approach to an independent civilization in the region which is the subject of this lecture. The Tacanas may have been, in fact were, a little higher in the scale of barbarism than their neighbours of the lowlands; and their manners and customs, clothing, and rude arts were an improvement on the pure savage.

Dr. Evans: I think we ought all heartily to congratulate ourselves, especially those who are interested in anthropology, on the splendid work the lecturer has done in Bolivia and Peru—work which is all the more valuable, because not only has he investigated the remains of a wonderful civilization of the past, but he has done his best to preserve the details of the existing superstitions and customs of races that are fast disappearing, at any rate, so far as a separate existence is concerned. I am sure that in the future anthropologists will look back to the work that has been done by him and others such as he, and congratulate themselves that it was carried out before it was too late. But not only is it anthropologists who must be grateful to our lecturer to-night, but philologists also. He has recorded vocabularies and a large amount of grammar of a number of languages of which little has hitherto been known; and I shall be glad to put at his disposal the materials I have myself collected. It is most remarkable that in this small district such a large number of different languages is to be met with. It is possible that, as Colonel Church contends, the number of separate stocks of Indians in South America is very limited, but, however that may be, the multitude of languages is extraordinary. D'Orbigny told us there were twenty-seven different idioms in a population of less than 50,000 in Mojos and Chiquitos: on the same scale London ought to have 2700 languages. Now, it seems to me that where a people has a language of its own it is entitled to be considered a separate race, even though it originally came from a common stock.

The lecturer referred to a civilization which existed in the plains beyond the mountains to the north-east. In this connection I may mention that reports are still extant which describe the visit of two Franciscans to the Toromonas and kindred tribes of this region almost exactly a hundred years ago. They give an interesting account of the prosperity and harmony that then prevailed in the district, which appears to have been more populous and civilized than it is at present. We can only regret that the Indians are so fast disappearing; we should have been glad to see them multiplying and populating those vast forests that they have so long made their home, but, unhappily, it seems that it is not to be.

The main course of the dwindling of the indigenous races is not the rubber industry, though that has caused their transfer from one region to another. So far as my own observations went, the Indians appeared to be well treated. There are exceptions, however, and in the outlying districts away from the influence of the Government, things have before now been done which cannot be too strongly condemned.

Terrible havoc has been wrought by zymotic diseases, such as scarlet fever, coming from the old world. But it is, above all, the consumption of ardent spirits that appears to be bringing about the extermination of the Indians. The population of the village of Santa Cruz del Valle Ameno is now only one-fifth of what it was before the distillation of rum was commenced in the immediately adjoining low country. It seems impossible to keep the Indian from spirits, the consumption of which is one of his greatest pleasures. An Indian friend of mine

at the isolated mission of San José de Chupiamonas told me that there were to be grand improvements there. On inquiry, these turned out to be nothing more or less than the erection of a still, so that sugar-cane juice could be converted into rum on the spot.

The CHAIRMAN: You will all agree with me that it is very kind of Baron Nordenskiöld to come all the way from Stockholm to read us such an instructive paper—one which has given rise to so much interesting discussion. I will ask you all to join with me in a cordial vote of thanks to the lecturer.

THE ECONOMIC GEOGRAPHY AND DEVELOPMENT OF AUSTRALIA.*

By J. W. GREGORY, F.R.S., D.Sc., Professor of Geology in the University of Glasgow.

I. POSITION AND CLIMATE.

THE economic geography of Australia is concerned with three main factors: First, the geological composition, which gives Australia its minerals, soils, and subterranean water-supply; second, its geographical position, which determines, through its climate and its commercial advantages, the use that can be made of its raw materials; and third, the quantity and quality of its labour.

The dominant fact in the position of Australia is expressed in its name of the "island continent." It has the sheltered position and possible homogeneity of an island, and the vast and varied resources of a continent. Its position has endowed it with a mild, beneficent climate, for most of it lies in the warmer part of the south temperate zone. The Tropic of Capricorn crosses the continent at its widest part, and, excepting North Africa, it is the widest mass of land crossed by a tropic. Its chief tropical areas occur in three great peninsulas, projecting northward into the warm seas of Malaysia. The southern half of the continent is more massive; so that most of the land lies outside the tropics, but confined to latitudes corresponding to those of Egypt, and reaching little further from the equator than Sicily. The middle line of the continent is along the parallel of 25°; its main mass lies between the latitudes of 18° and 35°; and the extreme range of the mainland is only from 10° 39′ S. at Cape York, to 39° 11½′ S. at Wilson's Promontory.

Australia has therefore, in comparison with its size, a very limited range in latitude. Its extension east and west, its insular nature, its uniform elevation, and its plateau structure give it a climate unique in its uniformity and regularity. Australia is robbed of the advantage of an insular climate by its size and its geographical

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* Read at the Royal Geographical Society, March 19, 1906.

structure. Its length is 2400 miles and its breadth 1971 miles, and its longer axis is parallel to the dominant movement of the winds; so they lose their characters as sea-winds long before they reach the central regions. The plateau structure and low relief emphasize the contrast of the interior and the coast lands. Australia is a plateau-land, and its highest summit (Mount Kosciusko, 7256 feet) is barely more than half the height of the highest peak in any other continent; it is much lower than the mountains of New Zealand or New Guinea. Hence there is no steady rise to central mountains, leading, by the continual ascent of air to colder heights, to the gradual precipitation of its moisture as widely distributed rain.

The geographical contrast in Australia is not between north and south, but between the arid areas and those that are fairly watered. This is not a simple contrast between the interior and the coast lands; for the distribution of the rainfall is governed by the temperatures of the water in the surrounding oceans.

The eastern coast is washed by a warm current flowing southward; accordingly moist winds blow ashore from a warm sea to a colder land; and as they are forced to rise over the East Australian Highlands, they drop their moisture in abundant rains. But on the western and south-western coasts the winds come from a cold sea to a warmer land; the air is warmed as it crosses the land, so its capacity for moisture is increased instead of being lowered, and it sweeps inland as a dry and even parching wind. Hence we have the contrast between the arid shores of the Great Australian Bight with their 10-inch rainfall, and the eastern coast on the same latitude with a rainfall of 60 inches.

The climate of Australia is governed by the passage of a succession of atmospheric systems. They sometimes cross the continent along a southern path, and leave the interior open to warm, moist winds from the tropics. On other occasions they pass along a more northern track, excluding the moist, tropical breezes, and letting in the cold, rough winds from the Southern Ocean. A succession of anticyclones crosses the continent with remarkable regularity. Each takes, on an average, eight and a half days in its passage, and the variations in its path and progress determine the conditions of the Australian weather.

Australia is in an exceptionally favourable position for the study of weather and climate; and we may expect from her contributions to scientific meteorology worthy of her opportunities, when she realizes how hopeful are the prospects of seasonal weather forecasts, and what incalculable benefits they would bring. The variations in the anticyclones are affected, and perhaps caused, by changes in the Southern and Indian Oceans; and it is not until our knowledge of the circulation of the water in those oceans has advanced, that we can hope to understand that alternation of drought and deluge, to which Australia is subject.

II. Structure and Materials.

The utilization of Australian materials is largely determined by the climate, but their nature and distribution is determined by the geological structure of Australia. It is a plateau land; and it is a plateau of great antiquity and uniformity. It has, moreover, been so long isolated from the main stream of organic development, that its own fauna and flora are archaic and unique.

Australia was once a land of great contrasts in relief; when it had lofty chains of folded mountains of the Alpine type, the earliest of which extended from south-east to north-west, across the whole width of Central Australia; and at later times a great mountain chain ran north and south along eastern Australia, from Victoria to the Cape York Peninsula. The summits of both mountain chains were snowclad; glaciers flowed down their valleys and deposited the Cambrian and the Carboniferous glacial deposits.

These old mountain chains were worn down to their stumps before the end of the Palæozoic period. The great folds that formed them have not been renewed; and since Mesozoic times the structure of Australia has been determined by the foundering of earth-blocks, leaving high plateaus and forming wide lowland basins, long valleys, narrow coastal plains, and isolated cauldrons.

A. *Geographical Subdivisions.*

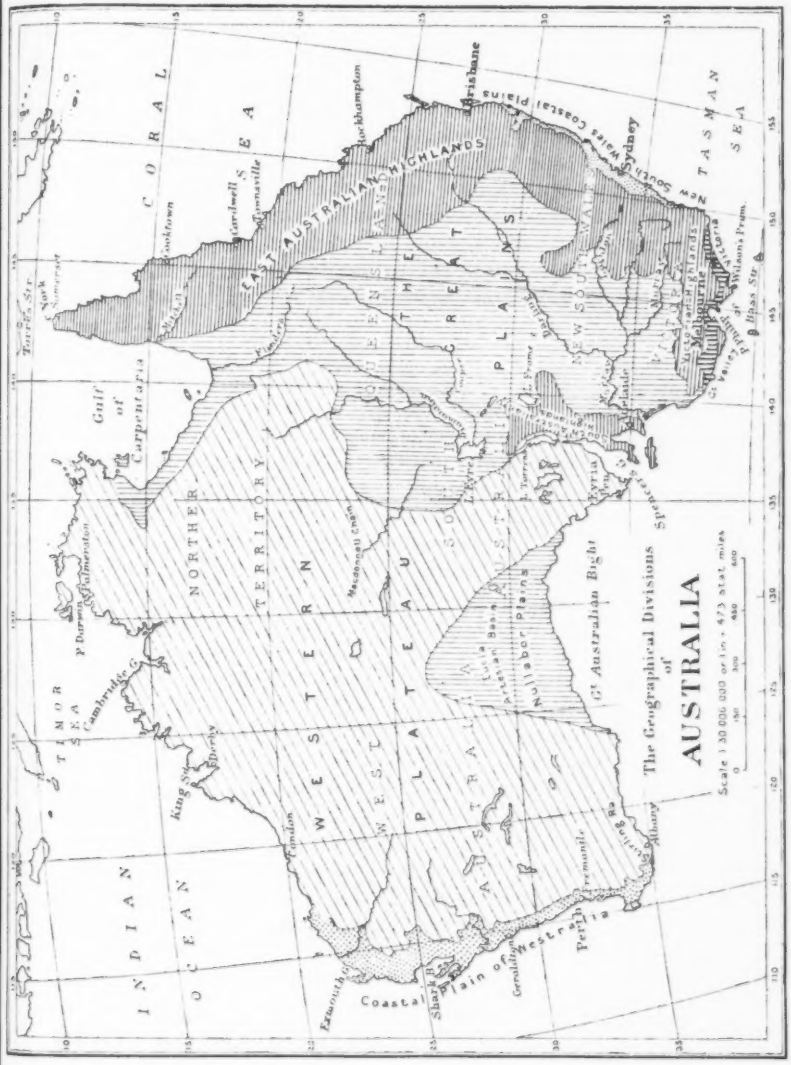
These vertical subsidences have broken across the old folded mountain lines, and have stamped upon Australia its present geographical divisions. They are three—

1. The East Australian Highlands, ranging from Cape York Peninsula, southward to Victoria. They are flanked to the east by the narrow, interrupted coastal plains of Queensland and New South Wales.

2. The Great Plains lie to the west of the East Australian Highlands; they extend from the Gulf of Carpentaria southward to the Southern Ocean, on the coasts of Victoria and eastern South Australia. These plains include the basins of the Flinders and Leichhardt rivers, Lake Eyre, and of the Murray and Darling.

3. The Western Plateau is a vast block of Archæan rocks, which forms the western half of Australia; it is bounded to the east by the remains of the old mountain chain that extended from Kimberley, through the Macdonnell Chain to the South Australian Highlands; projections northward and eastward, form the Arnhem Peninsula, the Barklay Tableland in Queensland, and the Barrier Ranges in New South Wales. The South Australian Highlands have been cut off from the Western Plateau by the formation of a rift-valley, the Great Valley of South Australia, including Lake Torrens and Spencer's Gulf.

The Western Plateau is indented by the basin of the Nullabor Plains, which run inland from the Great Australian Bight; and it is skirted



on its western and north-western margins by the coastal plains of Westralia.

The contrast between the East Australian Highlands and the Western

Plateau is the most marked in Australian geography. The surface of the Western Plateau is gently undulating, and consists of open, rolling, arid plains; the East Australian Highlands are a dissected plateau, which has been cut up into deep gorges and steep ridges, mostly covered by dense forest, passable only with difficulty. The difference between these divisions of Australia is due to the different effects produced by the denudation of plateaus in wet and arid regions.

The East Australian Highlands have been carved from a plateau in a well-watered land; the rain that falls upon them rushes in rapid mountain torrents down their slopes to the sea, or to the central plains; the powerful corrosion by the rivers and waterfalls had carved out deep canyons, which have been widened into valleys; and the old plateau has thus been reduced to a maze of gorges and a complex of narrow, sinuous ridges. The country, thus deeply dissected, clearly exposes its mineral wealth; and, as it is difficult of access, it is generally unsuited for agriculture, in spite of its often fertile soil and good water-supply. So it is necessarily left in the main to the pastoralist and the miner.

The Western Plateau has had a different history, and it is still a plateau; for it is in an arid region, where wind is the main distributing force. So the irregularities in the surface are levelled and the contours rounded, by the action of sandblast on the ridges, and the filling up of the valleys by wind-drifted sand and clay. The light rain has no powers of deep excavation; it only washes the loose soil down the hillsides into the hollows, where it accumulates in banks, breaking up the valleys into separate basins and clay pans. It is only near the plateau edge that the rivers have any powers of dissection, which even there are but slight. So the main part of the Western Plateau is being levelled, while the East Australian Highlands are being still more deeply sculptured.

Accordingly, in the western interior of Australia the mineral wealth is less well exposed; agriculture on a large scale is impossible; sheep raising is precarious; and even the existence of populous industrial communities is difficult, owing to the scarcity of water.

The Great Plains and the branch eastward therefrom along the Great Valley of Victoria, with their good turf, dry climate, low elevation, and mild temperatures, are best suited for sheep, and on them are the great sheep-runs that gave the first contribution to Australian wealth.

B. *Soils.*

The soils of Australia are in unusually close dependence on the geological structure of the country. The soils are mostly sedentary, *i.e.* formed by the decay of rocks *in situ*; and the only drift soils are those due to wind on the plateaus, or to river deposits on the flood plains of the rivers. The widespread volcanic sheets, which occur near the coast in all the states, decompose to a rich soil—the "chocolate

soil" of land agents' catalogues. This soil is rich in plant foods, lime, alkalies, and phosphates. The transported soils on the wide alluvial plains, and the sheets of wind-borne loam, are poor in phosphates; and the chemists who succeed in cheapening phosphatic manures can give the most effective help to the Australian farmer.

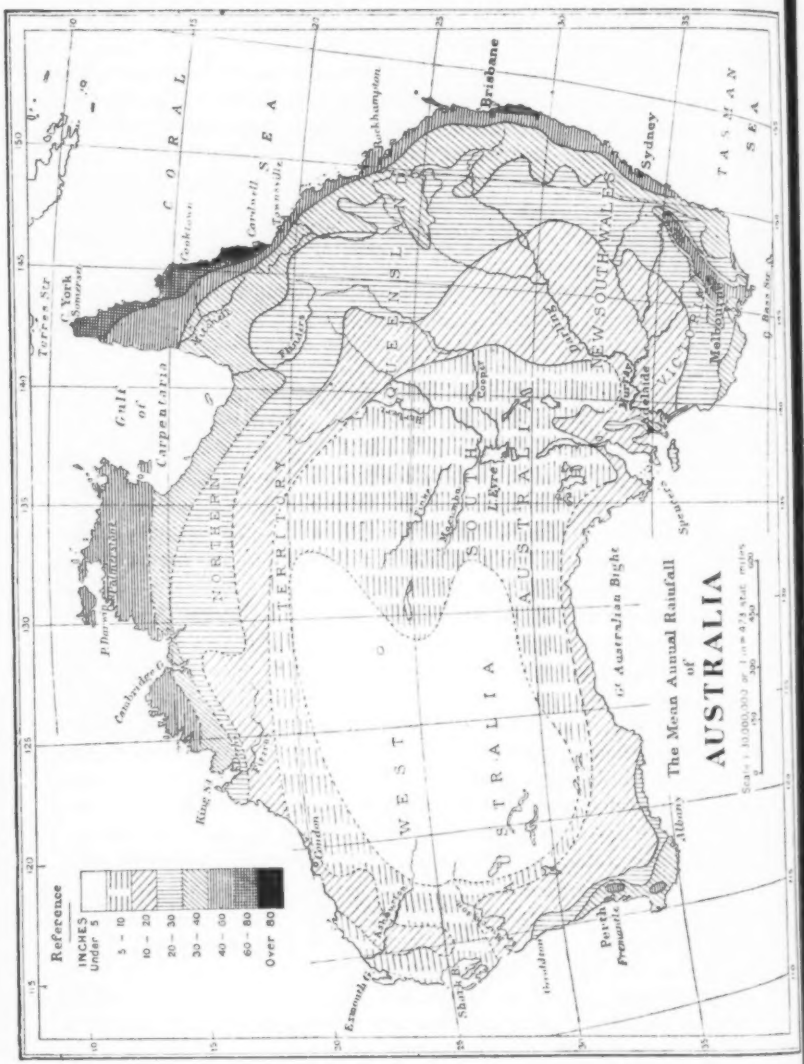
The Western Plateau, though barren through lack of water, has often a rich soil, for it consists of primary rocks, which contain abundant plant foods. In places where the grains of quartz accumulate, the soil is mere barren sand; but where clay is formed by the settling of wind-blown dust, or silt in a hollow after rain, the soil is rich in alkalies and phosphates. And as there is little vegetation to use up these plant-foods, they accumulate and form a soil of remarkable richness. Desert soils are nearly always rich; for they have slowly collected stores of soluble plant-foods, and their mechanical texture makes the soils light and warm.

C. *Water-supply.*

These rich rested soils now lie idle for lack of water. Once Central Australia was well watered, and then it was as fertile as a garden; but it has become arid. Its rains have dwindled, in places, to a miserable 3 or 4 inches a year, in a region where evaporation alone can suck up more than twice as many feet; so the rivers have ceased from running; their valleys have been blocked by barriers of earth; and the lakes thus formed have dwindled to mere shallow pools of brine, or even dried into sheets of poisonous salt crust. The centre of Australia—once a luxuriant garden—has now turned into the "Dead Heart of Australia," but it shows such clear evidence of its former fertility as to stimulate schemes for its revival. The shores of Lake Eyre are below the level of the sea; so the first idea was to flood its basin by a canal from Spencer's Gulf. This impracticable scheme was followed by a more fascinating idea. The most striking contrast between Australia and the other continents is that the interior is riverless. All of it has some rain; whither does this rain go? It does not flow in rivers to the sea, for most of the vast interior is either a basin of internal drainage, or of no drainage. Even its one great river, the Murray, discharges only a small proportion of the rain that falls upon its basin. Mr. H. C. Russell calculated that only 1·46 per cent. of the rainfall on the Darling basin above Bourke is discharged by the river past that town. What happens to the other ninety-nine per cent.? Russell rejected the idea that it could all be lost by evaporation. So he concluded it must percolate underground. If so, it must flow through some buried channel, and have some hidden outlet to the sea.

During calm weather there may be seen, in places along the southern coast of Australia, swirling columns of some liquid working its way upward to the surface. They are masses of fresh water surging up

through the denser salt water of the sea. The idea occurred to Russell that these submarine springs were the mouth of the subterranean river,


The Mean Annual Rainfall of AUSTRALIA
Reference
INCHES
Under 5
5 - 10
10 - 20
20 - 30
30 - 40
40 - 60
60 - 80
Over 80
CORAL SEA
TASMAN SEA
Brisbane
Sydney
Melbourne
Adelaide
Perth
Fremantle
Albany
Esperance
Eucla
Eyre
Cooper
Darling
Murray
Lake Torrens
Lake Gairdner
Lake Eyre
Lake Amadeus
Lake Mackay
Lake Macdonald
Lake Nash
Lake Frome
Lake Callabonna
Lake Blanche
Lake Hope
Lake Buchanan
Lake Gregory
Lake Disappointment
Lake Barlee
Lake Lefroy
Lake Cowan
Lake Moore
Lake Austin
Lake Grace
Lake Bryde
Lake Gilmore
Lake Dundas
Lake Barlee
Lake Carnegie
Lake Wells
Lake Mackay
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Lake Barlee
Lake Lefroy
Lake Cowan
Lake Moore
Lake Austin
Lake Grace
Lake Bryde
Lake Gilmore
Lake Dundas
Lake Barlee
Lake Carnegie
Lake Wells
Gulf of Carpentaria
Australian Bight
Cambridge Gulf
King Sd
Exmouth G
Shark B
Port Darwin
Port Essington
Cape York
Torres Str
Rockhampton
Townsville
Cooktown
Cardwell
Normanton
Burketown
Camooweal
Tennant Creek
Alice Springs
Oodnadatta
Marree
Hergott Springs
Port Augusta
Port Lincoln
Streaky Bay
Ceduna
Fowlers Bay
Eucla
Esperance
Albany
Bunbury
Geraldton
Carnarvon
Onslow
Roebourne
Port Hedland
Derby
Wyndham
Halls Creek
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Broome
Derby
Wyndham
Halls Creek
Fitzroy
Broome

continents is that, whereas their rivers flow over the surface, the main river system of Australia flows underground. It seemed a beneficent and providential arrangement, whereby the water would be carried through Central Australia protected from evaporation as in a pipe. If only this pipe could be tapped at intervals, the water would be obtained where it was wanted, and the rested soils of Central Australia might again be as fertile, as when the fabled kadimakara revelled in the rich herbage around Lake Eyre. The idea was promptly tested. Suetonius Officer, a Melbourne landowner, sunk some wells on his station of Kallara, in the far west of New South Wales. He was rewarded by reaching water, which overflowed from the mouth of his wells. Under the stress of heavy drought, and guided by the geological insight of Dr. Jack, Queensland, in 1885, began the first bore to test the possible occurrence of deep-seated waters beneath its arid western plains. In 1888 the enterprise was rewarded by the bore, at the depth of 1645 feet, reaching water, under such high pressure, that a stream rushed to the surface and discharged at the rate of 291,000 gallons a day. This success led to an active search by boring, in areas where the geological surveys of the different States indicated that the deep well waters might be found. By the end of June, 1904, Queensland had 596 flowing wells, yielding 62,635,722 cubic feet a day; New South Wales, 248 wells; and South Australia, 20.

The opening of these wells naturally led to the hope that they might render widespread cultivation possible in the Great Plains. The water is enough for some intense cultivation around towns; it maintains permanent watering-places for stock, on routes that would otherwise be impassable. The wells supply some towns with their domestic water; one of the wells lights Roma with natural gas; and some of the wells may be used for the cultivation of lucerne to feed stock during a period of scarcity. But for extensive irrigation this well-water is quite inadequate. Moreover, the calculations as to the amount of this water available seem to me to rest on a wrong basis. It is generally believed that the wells are truly artesian, of the same nature as the flowing wells of Flanders, Paris, and London, where the water that falls on the adjacent hills, percolates underground into the deepest part of a trough-shaped fold of chalk; thence it is forced to the surface, up any bore-hole through the overlying clays, for the same reason that water poured into one side of a U-tube will rise up the other. The average rainfall on the Queensland hills is about 22 inches, or 319,000,000 gallons, of water per square mile. The area which receives this amount of water on the western slopes of Queensland and New South Wales is so large, that, if much of the rainfall could be caught, the amount available would be enormous. According to some estimates, it is calculated that 25 per cent. of this rainfall percolates underground, and is available for collection from the deep, water-bearing rocks. One distinguished

geographer asserted that it is as idle to fear the exhaustion of this underground reservoir, as it would be to drain the ocean by pumping from it; and many responsible geologists have concluded that the amount of water discharged from all the flowing wells of the central basin of Australia, is so insignificant, compared with that which drains away wasted to the sea, that there need be no hesitation in increasing our demands on the supply, or even troubling to avoid waste. But the simple theory that the water rushes up these wells owing to the hydrostatic pressure of the water in the Queensland hills, seems to be contradicted by the evidence. I have recently discussed this question, and pointed out the facts, which seem to me to show, that much of this water is not rain-water which has worked downward; but it is plutonic water, which has risen from the deeper layers of the Earth's crust; and that the water rushes up the wells owing to the tension of its included gases, and the pressure of the over-lying sheets of rocks. We have at present no means of calculating the available supply, and there is every probability that it is not inexhaustible. Many of these wells have already reduced their yield, warning us that they derive their water from the accumulations of former ages. Politicians have proposed to limit the waste of water which now goes on, and I hope that the legislation proposed some years ago will be promptly reintroduced, so that this invaluable asset may be used to its fullest advantage.

D. *Pastoral and Agricultural Areas.*

The geographical divisions of Australia mark off the country into areas which are suited for industrial, agricultural, and pastoral occupation, and into the vast tracts of the interior, which are, at the present time, of no use for anything. The industrial districts are on the mining-fields and at the chief ports. The best coal-fields are in the coast lands of New South Wales, Victoria, Tasmania, and Queensland; and there are fields with inferior coals on the Western Plateau, and most of the states have deposits of brown coal, especially in the coast lands.

The difference between the pastoral and the agricultural lands is relative. It depends upon their accessibility by railway as well as on the rainfall. At first the western plains of Victoria were of value only for pastoral purposes; but as the railways extended across them, as towns grew up on their borders, providing better markets for perishable produce, and as a denser population afforded a better labour-supply, pastoral districts have become agricultural.

The four railway lines that traverse the north-western plains of Victoria have converted land, once barely of any value even for pastoral purposes, into the great granary of the state. And as the arid plains of the interior of the continent rest mainly upon rocks of primary composition, their soils are rich in food materials, and could be used for

agricultural purposes, whenever there is an adequate water-supply and transport for the crops. The three northern peninsulas have areas of rich volcanic soils, and as they have heavy rainfall, these districts could, with adequate labour, grow valuable tropical products, such as cotton.

E. *Mineral Resources.*

The geological composition of Australia also determines the nature and distribution of its mineral wealth, which has yielded materials to the value of over £600,000,000.

Its most famous industry is its gold-mining, which dates from 1851. Gold had been found long before; the first definite record was by James McBrien, a surveyor in the Lands Department of New South Wales, who wrote in his field note-book * for February 15, 1823, that close to a gum tree, which he marked, beside the Fish river, he had "found numerous particles of gold in the sand in the hills convenient to the river."

This news was suppressed; and when, sixteen years later, Count Strzelecki found gold in the vale of Clwyd, he too was persuaded to conceal the fact, as the nervous governor feared its publication would have revolutionary political consequences.

It was not until 1851, that the occurrence of gold in mining quantities, and not as mere museum specimens, was made known by Hargraves; and the search in Victoria, roused by his results, led, on August 24, 1851, to the earliest discovery of first-rate mining importance—the gold-bearing gravels of Golden Point, Ballarat. The diggings there showed that Australia was one of the great goldfields of the world, and began the active mining, by which Australasia has contributed £500,000,000 of gold to the world's treasury.

The Australian goldfields are unusually varied in character, wide in their distribution, and stimulating in their many novel problems. Their new and peculiar difficulties have developed a courage, enterprise, and originality, which now enable the Australian miner to work ores of unprecedently low grade, and have led to inventions and new methods that help the miner in every mining country of the world.

1. *Surface Alluvial Deposits.*—Gold-mines are divided into two main groups, alluvial deposits and gold-bearing lodes; and though both of them have yielded the most easily accessible of their richest ores, the geological conditions of the Australian fields show that they are not exhausted. There remain supplies of gold that will keep Australian mining active for generations to come.

The alluvial deposits include surface gravels, sands, and loams, which contain grains and nuggets of gold derived from the decomposition of gold-bearing lodes.

* A photographic facsimile of this entry is given by E. F. Pittman, 'The Mineral Resources of New South Wales,' 1901, p. 1.

Such were those rich tom-tiddler's grounds, the alluvial diggings of Victoria, at Ballarat, Bendigo, and Castlemaine (the Mount Alexander diggings), and the gold alluvials of Westralia, begun by the discovery of Coolgardie in 1892. These rich patches were confined to the immediate neighbourhood of the lodes, and were soon worked out; but alluvial mining has continued on deposits more difficult to reach. Most of the older gravels are buried beneath sheets of clay. The miner finds them first at their outcrop, and when the shallow deposits are worked out, he has to dig shafts and follow the materials underground. Thus began the mining of the older, deeper gravels.

2. *Deep Leads.*—The available extent of the gold-bearing gravels in Victoria appeared to be greatly reduced by vast sheets of lava, some of which occur in the richest of the gold-bearing regions. These lavas hid, once it was feared for ever, the gold-bearing rocks beneath them. At Ballarat the mining of the surface gravels ended against the face of the igneous rock, that forms the Ballarat West plateau. The rock wall repelled the cosmopolitan army of miners, who were camped on the plain beneath, as successfully as the walls of Sebastopol were then resisting the allied armies in the Crimea. So the miners called the plateau Sebastopol. Its resistance was at length overcome. It occurred to some miners on the adjacent goldfield of Cresswick, who were faced by a similar obstacle, that perhaps the igneous rock was not a deep-seated block, like a granite, but might be a surface lava-flow, beneath which the gravels might continue. This idea was tested; it was found to be true, and this enterprise begun the deep-lead mining. The Ballarat miners at once renewed the attack on their Sebastopol; they mined under its walls, and found the gold-bearing gravels beneath it. Farther back from the edge they sank shafts through the surface lava; and during this work they discovered the quartz reefs at Ballarat West, from which the leads derived their gold.

Twenty years later, this system of mining received still greater extension. From the volcanic region of the central Highlands of Victoria, long bands of lava extend northward. About thirty years ago, Mr. Reginald Murray, then Government Geologist of Victoria, recognized that these long basalt plains were lava-flows filling up old river-valleys, and that, therefore, the gravels of these rivers have been preserved beneath the surface. The lava plains occur among the richest goldfields of Victoria, and therefore it could reasonably be expected that the gravels on the old river-beds would be rich in gold.

The mining of these gravels has required new methods. The exact position of the gold-bearing gravels has first to be proved by drilling lines of bores across the lava plains, to determine the course of these ancient river-beds, and the depths at which they occur. By extensive boring operations, in which the Victorian Government, with statesman-like foresight, has spent nearly £200,000, the course of many of the

ancient river-systems has been determined. Thus the course of the ancient Berry-Moorlort-Loddon lead can now be represented on a map like a modern river, but the river-bed is buried under hundreds of feet of lava. The mining of these river gravels, after their course has been

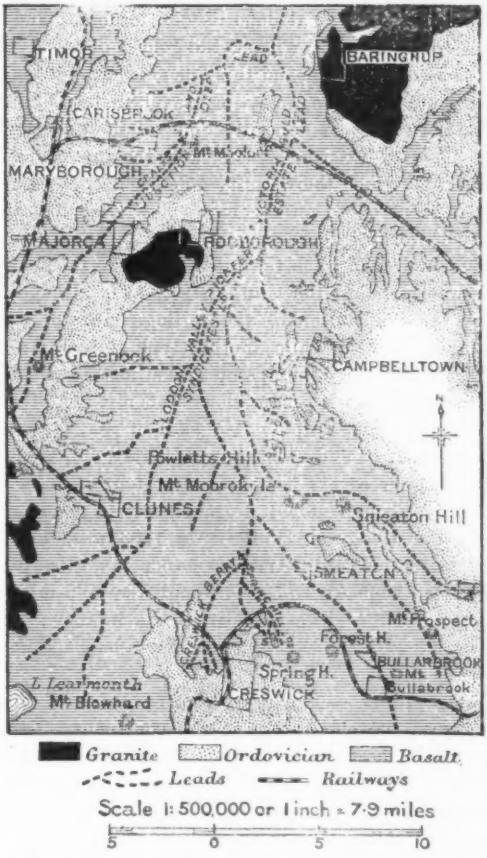

FIG. 3.—GEOLOGICAL SKETCH-MAP OF THE BERRY-MOORLORT-LODDON LEAD.
(*After Stanley Hunter.*)

determined, has especial difficulties; for the gravels occur below water-logged quicksands, which require to be drained before the miner can remove the gold-bearing layer. The pumping is often a long and costly task. Mines may have to pump millions of gallons a day for years before any gold can be got from them. Thus, according to a cable published on February 15, the two neighbouring mines, the Loddon Valley Goldfields

and the Victorian Deep Leads, together pumped, in the month then reported, 250,000,000 gallons of water. This pumping may have to go on for years. But so rich are the gravels, and so cheaply can they be mined when once they are drained, that they often give handsome returns for the heavy cost of the years of patient pumping.

3. *Gold-dredging.*—Alluvial deposits of a different and poorer type occur further from the lodes, whence the gold is derived. Only a little fine gold is carried into them, and this fine gold may be scattered loosely through a thick bed of loam, clay, or gravel, instead of being concentrated on the bottom of the deposit. Some of these low-grade deposits are on the floors of existing rivers, and the gravels could only be obtained at a cost, which their scanty gold would not repay.

In 1891 it occurred to an ingenious New Zealand miner that the cheapest way of working these gravels would be to haul them up by a bucket-dredge, and then wash the gravels on the deck of the dredge. The system was tried on the Clutha river. The dredge was greatly improved by the application of the tailings elevator, invented also in New Zealand, in 1894; while another type, the suction-dredge, by a powerful centrifugal pump, pumps up gravel instead of water.

These dredges work with marvellous economy. In favourable conditions a dredge will haul up a cubic yard of gravel from the bed of a river, wash it, sort it, and extract from it its gold, at the cost of 2*d.* Hence, if a dredge recovers two grains, or four pennyworth of gold per cubic yard (or about $1\frac{1}{3}$ tons) of gravel, they pay well. The average gold yield of the dredges in Victoria in 1903 was only 2·25 grains, or 5*d.* of gold per cubic yard. With such economy, this system of gold-mining has spread from Australasia through the gold-mining countries of the world. But the system is still in its infancy; and this New Zealand invention will enable a vast increase to be made in the ultimate gold yield of Australia.

4. *Auriferous Lodes.*—The gold-bearing lodes of Australia are scattered through the older rocks of the continent. Every state has them; they are richest, in comparison to its area, in Victoria, and poorest in South Australia. These lodes are of many different types. The simplest are the gold-quartz veins formed along fault planes, and they are usually the easiest to work.

The Australian gold-bearing lodes are of unusual variety in their modes of occurrence; they occur in rocks of many different ages and of different kinds, volcanic, plutonic, sedimentary, and metamorphic. They occur as simple quartz veins along fissures and faults; as quartz veins ramifying in an irregular network, through fractured masses of slate and sandstone; as "saddle reefs" in contorted slates and quartzites, as at Bendigo and Hargraves; they occur as metasomatic or replacement lodes in slates; and as mineralized bands of schist, granite, slate, and volcanic tuff; in propylitized

diorite dykes; and along faults beside which augite andesites have been altered to serpentines. They are distributed through rocks of many ages; they are most abundant in the Archæan schists, as in Westralia and Victoria, and in the Ordovician slates, as at Bendigo and Castlemaine; they also occur in the Silurian slates and sandstones of Victoria and New South Wales, in the Devonian and Carboniferous rocks of the East Australian Highlands, and in New Zealand in the Oligocene volcanic rocks of the Thames goldfield. Many of the mines are worked to great depths; they are working at 4250 feet at Bendigo, 2300 feet at Ballarat, and 2000 feet at Kalgoorlie. Nevertheless, in many of the fields the works are still quite shallow, though the ore-shoots probably often go down much deeper, and will yield good returns to mining in future.

5. *Silver and Base Metals.*—The mineral wealth of Australia also includes rich deposits of lead, silver, zinc, copper, and tin. Its most important copper-field is at Mount Lyell. There, thanks to the combined practical skill and high theoretical knowledge of its manager, Mr. Sticht, the difficulties which have long prevented the adoption of pyrite-smelting have been overcome, and the ores are being mined and smelted at the low cost of 13*s.* per ton. The chief mines of lead, silver, and zinc are at Broken hill, where the output of the mines lowered the price of silver; and, thanks to the ingenious device of separating the zinc ore from the rhodonite, by making each little grain of ore develop its own buoy of gas-bubbles, the vast stores of zinc are now available for the service of mankind.

6. *Coal and Iron.*—Perhaps more important in their ultimate influence than even the gold-mines are the vast coalfields and iron ores of Australia. The coal-fields are mainly in New South Wales; and they can safely be described as the greatest and best-placed coalfields in the southern hemisphere. They have been most worked where the coal-measures outcrop on the surface around Newcastle and up the basin of the Hunter river. But they extend to the south, buried by later rocks, and have been proved in a 10-foot seam at the workable depth of 2917 feet under Sydney.

In the other states, Victoria has a high-quality coal in Jurassic rocks; and coal of the same age occurs in Queensland, in the Ipswich district, and in South Australia, in Leigh's Creek. Tasmania has coalfields in the basins of the Mersey. Western Australia has coals in the Collie Field, of which the age is still uncertain. Vast deposits of brown coal occur all through Australia, especially in the Great Valley of Victoria; but though the amount there is enormous, no exact estimate is possible; for the bores prove the patchiness of the deposits, and as adequate assays were not made from all the cores, material that can only be described as carbonaceous shale has been included in the records as brown coal.

The iron ores of Australia are of high quality and wide distribution.

A report by a commission of the Federal Parliament has called attention to their amount; and with vast accessible supplies of good ore, suitable fluxes, and cheap coking coal, I am confident that in the future —with the possible exception of China—Australia will beat the world's record in the cheap production of iron.

III. Economic Development.

The economic development of a country with the geographical characters and position of Australia naturally passed through three stages. It could at first be most easily utilized for the raising of cheaply produced materials, which could stand long-distance transport without injury, were of sufficient intrinsic value to pay the cost of freight, and would return a sufficient reward for the expense and inconvenience of pioneer life. Australia was a wide land, with unbounded acres, but little labour. So it was particularly suitable for sheep-breeding, which could utilize the maximum of land with the minimum of labour. It was a sound instinct which led John MacArthur, in the early days of the Sydney colony, to devote his energies to the improvement of Australian sheep-breeding. Dissatisfied with the quality of the half-bred merinos, which were the best that could be got from the Cape, he tried to procure pure merino sheep from Spain. But their export was a capital offence, and MacArthur's efforts were foiled. But then came the Peninsular war; and it was characteristic of Australian methods that it seized this chance of getting the coveted Spanish sheep, and by careful breeding developed its high-quality wool.

The pastoral industry was the first that gave Australia its wealth, and the wool export from 1851 to 1903 alone, was, according to Coghlan, of the value of £610,000,000. Despite the havoc of the last drought, Australia has now over 73 million sheep, and has the greatest yield of wool of any country in the world. It has more sheep than the rest of the British Empire. During the development of this pastoral industry, Australia wanted capital to buy machinery and make roads and public works. So it inevitably adopted a free-trade policy, so as to produce, at the cheapest possible rate, as much material as possible for sale to Europe. This policy was reinforced on the foundation of the mining industry in 1851; for Australia wanted to import machinery, rails and railway plant, tools and clothes for its miners at the cheapest rate, while it employed its people in industries that gave a quicker return and used less capital than manufacturing.

Australian Manufacturing Industry.

But with the increase of population it has been possible to develop industries that produce higher-priced commodities, and yield higher profits than can be got from the sale of raw materials. At first manufactures were restricted to such articles as clothes and food, of which

local production was necessary, or low-priced bulky materials, such as bricks and furniture, which could not afford long-distance transport. But with increased labour-supply, and the occupation of all the naturally cleared, accessible land, and the exhaustion of the most easily worked gold deposits, other industries became profitable. Diggers bought land and became farmers. Large sheep-runs have been cut up into dairy farms, and the calcareous loamy soils have been ploughed into wheat-fields. Australian agriculture has the advantage of the seasons alternating with those of Europe; so her summer produce and autumn fruits reach Britain when there is least local competition. The national ingenuity has helped the farmer as well as the miner; and much land that could not otherwise have been tilled has been brought under cultivation by the stump-jump plough, and the invention of the stripping harvester enables the wheat-fields to be reaped most economically.

Australia has, therefore, seen a great development both of her agricultures and manufactures. In 1903, according to Coghlan's* estimate of the value added by manufacturing processes to the raw materials (much of which would otherwise have lain waste), manufacturing made the greatest, and agriculture the second greatest, contribution to Australian wealth.

	£	£	s.	d.		
Manufactures: the value added to the raw material by manufacturing	28,528,000	or 7	5	8	per head of	population.
Agriculture	26,792,000	„ 6	16	9	„	„
Pastoral	25,620,000	„ 6	15	2	„	„
Mining	23,838,773	„ 6	1	9	„	„
Dairy industry	7,130,000	„ 2	5	0	„	„

Part of the results from dairying, moreover, should be added to those from manufacturing, as its main product, butter, is made in co-operative factories, from milk raised by small dairy farmers.

(To be continued.)

THE GEOGRAPHY OF INTERNATIONAL FRONTIERS.†

By Major E. H. HILLS, C.M.G., R.E.

THE importance of clearly defined boundary-lines between the territorial possessions of rival nations is too obvious to require any labouring. That ill-defined boundaries are a fruitful subject of international

* It has not seemed necessary to include many statistics in this paper, as complete figures are given in that invaluable storehouse of information, Coghlan's 'A Statistical Account of Australia and New Zealand,' issued annually by the New South Wales Government. Published in this country by P. S. King & Son, Great Smith Street, Westminster.

† Address to the School of Geography, Cambridge, May 5, 1906.

dispute has been proved again and again and, in view of the fact that one such dispute is actually at this moment in a somewhat critical stage, we need not go outside the present time for an example in point. It follows, therefore, that the fixing of frontier lines is one of the most important acts of the government of a country and one that should not be undertaken without a due weighing of all the conditions and a due understanding of the geographical questions involved.

As will be readily understood I am here, and throughout this lecture, speaking more particularly of new frontier lines, such as we meet with in delimiting our African possessions, not so much of old-established frontier lines in highly civilized countries. The latter fulfil their objects if they are clearly marked both upon the maps and upon the ground, and are fully understood and accepted by both parties. For the settlement of new frontier lines the problem is a different one and calls for a more complete solution. In this case we are concerned, not only with the frontier as an accomplished fact, but also with the frontier in process of making, and the ease with which it can be surveyed and marked out upon the ground becomes an important factor. The time element often enters into the problem, generally complicated also by financial restrictions, and the question then to be answered is, not what is the best possible frontier line to select, but what is the best line that can be surveyed and laid out within a stated period of time and with a definite limit of cost?

As in most practical affairs, the solution must be of the nature of a compromise which renders it all the more important that the original agreement or treaty, wherein the proposed frontier line is first defined, should be drawn up in the most lucid manner and with the actual conditions of the practical problem clearly in view. Unfortunately, such treaties have been often drawn by diplomatists, whose knowledge of geography may be small and whose knowledge of practical survey work is *nil*. Hence much future trouble, which could have been avoided, or anyhow minimized, by more "clear thinking" at the outset. To assist in this "clear thinking" and to indicate briefly some of the more important factors ruling this problem of frontier definition, are the objects of the present lecture.

The conditions which the perfect frontier should fulfil may be postulated as follows:—

Firstly, it should be an actual barrier to the people on either side of it. This is a condition which obviously can only rarely be met.

Secondly, it must be clearly indicated upon the ground, so that the most ignorant can have no excuse for mistaking its position. To this end, it must either be marked by natural features or by artificial monuments or beacons. In the latter case, the relative facility with which the ground can be surveyed and the beacons erected in position with the requisite accuracy becomes a fundamental point.

Thirdly, it should be stable, not liable to secular changes.

Fourthly, if lying in an inhabited district, it should, wherever practicable, respect existing ethnological or tribal boundaries. In giving weight to this condition, it is necessary to guard against attaching undue importance to such boundaries when only of a temporary character or when dealing with tribes known to be of wandering habits.

All frontiers are capable of division into two main classes: natural frontiers, such as rivers and watershed or crest-lines; and artificial frontiers, comprising conventional lines upon the Earth's surface, parallels of latitude, meridians of longitude, and "straight" lines between fixed points. In the latter category we must also include frontiers defined "by reference" to existing conditions, such as frontiers following existing provincial boundaries, tribal boundaries or roads, or defined as passing within a certain distance of a town or village.

Let us take these various types *seriatim* and see how far they fulfil, and in what respects they fall short of, our ideal conditions.

River Frontiers.—The advantages accruing from the selection of a river as a boundary-line are, in the first place, that its position is quite obvious, and, in the second place, that it requires no survey operations to delineate it. In the case of an unknown river such operations are interesting for the purpose of laying down its course upon our maps, but are not necessary for the delimitation of the frontier.

An example of the economy of time and labour arising from this quality of the river frontier occurred recently in the course of the delimitation of the boundary between the republic of Liberia and the British colony of Sierra Leone. Starting at its northern end this frontier was defined by a certain meridian line until it met the Mannah river, which it then followed to the sea. Roughly about two-thirds of the line was along the meridian and the remaining one-third along the river.

Owing to the densely wooded nature of the country the survey proved extremely difficult and the traverse of the north and south line and the erecting of the necessary beacons, necessitated many months' hard work. When the boundary commission reached the river their work was finished and they travelled to the coast by the shortest route. Had it been necessary to traverse and survey the whole river another season's work and a further expenditure of several thousand pounds would have been involved. At the same time, though this river was not traversed by the commission and its actual course, between the point where the meridian cuts it and the coast, is unknown, it forms a valid boundary, the existence and position of which is known to every native in the locality. Furthermore we may note that the beacons erected along the straight portion may easily, unless well cared for,

become overgrown and obliterated, while the river remains visible so long as rain falls and water flows.

Per contra, we must reckon it a disadvantage that a river, by the easy means of communication and transport it offers, rather connects than separates the races on its two banks. For this reason it is comparatively exceptional for large rivers to be accepted by old nationalities as boundaries.

All rivers are liable to secular changes of their course arising from the denudation of one part of their banks and the accretion at others, and in certain exceptional cases, notably that of the Yellow river, they have broken into entirely new channels. In such circumstances it becomes important to decide whether the frontier-line shall follow the new course of the river or remain immutably fixed in its old position. The accepted ruling in this case follows what I believe is the ordinary practice of English law, viz. that any slow, continuous change of course carries the frontier with it, while a *per saltum* change into a new channel leaves the frontier in the old channel, even if that be completely deprived of water. In defining a frontier as following a river it is necessary to state the precise line to be taken, which may be either the *medium filum*, or midstream, the line midway between the two banks, or the thalweg, the bottom line of the valley or line of deepest channel of water. Of these the mid-stream is the most stable in position; many tropical rivers, for instance, change their actual channels repeatedly, while their whole bed, only filled at times of extreme flood, lies between banks not liable to any but slow change. On the other hand the thalweg is most readily identified and can always be found so long as there remains a trickle of water in the channel. Modern practice is in favour of the selection of the thalweg for this reason. If one of the nations concerned claims the whole waters of the river, with all navigation and other rights, the boundary can be defined as following the river-bank or even a line at a certain minimum distance from the bank.

It should be noted that the definition of a frontier as a line parallel to a river is not a satisfactory one as such a line may, when following internal bends or angles, cut itself. In all cases the use of vague terms such as the "course" of a river should be studiously avoided.

Watershed Frontiers.—In discussing the merits of the watershed-line as a boundary we must, in the first instance, note that the word "watershed" has an unfortunate double meaning in the English language, *i.e.* it is sometimes used as signifying the basin or drainage area of a river, and sometimes the crest or water-parting line separating two contiguous river-basins. The latter seems to be the only legitimate use of the word, but as it is commonly used, whether in error or not, as a synonym for basin, it is preferable in formal documents to avoid the word altogether, and write in its place "line of water-parting."

When lying in high ground the water-parting line forms, on the whole, the most satisfactory frontier that can be found; it is readily identified, requires no survey to delimit its position and is perhaps, of all geographical features of the Earth's surface, the one least liable to secular change. When raised above the snow-level, so that it cannot be crossed except at certain definite passes, such a line forms an ideal barrier between nations.

When drafting the description of such a frontier, care must be exercised that no misunderstanding can arise as to which water-parting line is intended to be taken and to this end it is always advisable to enumerate the precise river-basins that the line is to separate. Much confusion has arisen in the past by looseness of definition due to imperfect geographical knowledge. Thus the long-standing dispute between the republics of Argentina and Chili had its origin in an assumption that the continental divide, separating the waters which flow into the Atlantic from those flowing into the Pacific, was coincident with the general crest-line of the highest peaks of the Andes. Apart from the difficulty that the Andean range has nothing which can be described as a general crest-line, the continental water-parting is at places very far removed from the mountain region and runs out into the comparatively flat ground of the pampas. The claims of the two republics, one demanding a frontier along the continental divide without any deviation, and the other a line along the highest peaks of the Andes, following, as far as possible, the principal north-and-south "backbone" of the range, were quite incompatible, and were finally submitted to the arbitration of His Majesty the King.

In flat ground, on the other hand, the water-parting line forms a less desirable boundary. The advantage of ready identification is lost, and the actual position of the line can only be found by somewhat refined levelling operations. Hence, if used as a frontier it requires beaconing thus losing part of its character as a "natural" line. In an extreme case the water-parting line may even lie in a lake or marsh and thus become indeterminate. As an example of this we may cite the case of Lake Amucu, on the watershed between the Rio Branco and the Essequibo, which is reported to drain in both directions.

A somewhat similar example occurs at the confluence of the Zambezi and Shiré rivers where the two main streams are connected, at some distance from their actual junction, by a channel called the Ziwa-Ziwa river. The direction of flow of water in this channel was a subject of difference of opinion between those who had visited it but there seems good reason for supposing it to vary with varying climatic conditions. If this really be the case, and the water in the Ziwa-Ziwa flow at times from the Zambezi to the Shiré and at times in the

contrary direction, we should have the phenomenon of the Zambezi-Shiré watershed shifting its position with the changing seasons.* There are doubtless other cases of flat marshy ground situated on the separating line between river-basins the drainage of which is liable to seasonal change. The supposition that a water-parting line is always well defined and is immutable in position is thus unsupported by the facts and frontier treaties based upon such lines must be drafted with due caution. In many cases it would be preferable to depart from the watershed where the latter enters upon an area of level country and to substitute straight lines. The excessive amount of curvature and winding of a watershed in such an area is an additional reason for this simplification.

Artificial Frontiers.—In this term we include all lines which, not being natural features of the Earth's surface, must, if used as frontiers, be marked out by artificial means—boundary posts, monuments, cairns, or beacons. All such frontiers have, therefore, the common objection that they must be minutely surveyed and beaconed throughout their whole length. This preliminary work once over and the positions of the beacons or frontier-marks fully accepted by both parties they lose their chief defect. The slight initial disadvantage under which they labour often ultimately acts to their advantage by compelling careful delimitation and survey and removing the temptation to leave the settlement to a mere paper definition.

Frontier definitions based upon parallels, meridians and straight lines are very tempting to diplomatists on account of the fatal facility with which such lines are ruled upon a map and are embodied in a treaty. In making use of such lines it is very important to bear constantly in mind the relative accuracy with which their positions are known. Thus in an unsurveyed country the position of a meridian, or, in other words, the longitude of any given place, is liable to much larger errors than the position of the parallel or its latitude. Repeated instances have occurred of the danger of accepting meridian-line boundaries in little-known country. Thus the 30th meridian of east longitude, in the neighbourhood of Lake Albert Edward and the Ruwenzori mountains, was given a position on the maps about 30 miles in error at the time when a frontier agreement was drawn up between this country and the Congo State.

A somewhat striking example of the disadvantage of a meridian frontier has lately come to light in the case of the Anglo-Congolese

* The water-parting line between two rivers terminates at the point where their waters first meet. Thus if the Ziwa Ziwa flows from the Zambezi to the Shiré, the first point where Zambezi water meets Shiré water is the junction of the Ziwa-Ziwa and Shiré. If the flow in the channel is in the reverse direction the meeting-point of the waters is the Ziwa Ziwa-Zambezi junction.

frontier in the neighbourhood of Lake Bangweolo. The agreement between Great Britain and the Congo State of May 12, 1894, defined this section of the frontier as follows: "The thalweg of the Luapula up to its issue from Lake Bangweolo. Thence it shall run southward along the meridian of longitude of the point where the river leaves the lake, to the watershed between the Congo and Zambezi."

When this agreement was drawn the existing maps showed the course of the river as lying well to the westward of the meridian drawn through the point where it leaves the lake. Later surveys have, however, shifted the relative positions of river and meridian with the effect of moving the stream so far towards the east that it now intersects the meridian line in two, if not in four, places. A delimitation of this boundary in strict accordance with the treaty is therefore impossible, in that it would result in islands of inaccessible territory cut off between the straight line and the river-bends. A new set of negotiations are therefore imperative, a necessity due to the unfortunate wording of the original agreement.

Boundaries following parallels of latitude are unobjectionable. Existing frontiers of this nature, *e.g.* the 49th parallel between Canada and the United States were laid out by astronomical observations and are substantially in error owing to the variation of local attraction. At the present time such a frontier would be laid out by triangulation so that this particular source of error would be eliminated. A recent example of this class of boundary is the Anglo-German frontier west of the Victoria Nyanza which follows the parallel of 1° south and was delimited by a triangulation survey extending about 20 miles on either side of the line.

A meridian-line boundary would now be laid out in the same way.

The case of a frontier following a straight line between two points on the Earth's surface gives rise, unless the positions of both points are quite accurately known, to grave difficulties in delimitation. Long lengths of such a frontier are most undesirable in a new or rugged country and necessitate a detailed triangulation extending over a wide belt. Alternatively such a line can be delimited by traversing it twice, once to determine the relative positions of the terminal points and a second time to mark the line on the ground.

Many frontiers of this class have been delimited in Africa and there are some still waiting demarcation. Thus the eastern boundary of Nigeria, separating that colony from the German Kameruns, is for the most part a series of straight lines. The southern section running from the "rapids" on the Old Calabar or Cross river in the direction of the town of Yola, lies in a very difficult country and has not yet been surveyed. The northern section from Yola to Lake Chad was surveyed about three years ago.

The agreement which established this frontier was that between

Great Britain and Germany of November 15, 1890. The fact that a lapse of nearly sixteen years after the signing of the treaty still finds much of the line undelimited cannot be considered a subject for congratulation, and without throwing too much of the blame for this delay upon the wording of the treaty, we cannot fail to see that a frontier definition based upon fixed points, viz. the "rapids" of the Cross river, Yola, and the intersection of the southern shore of Lake Chad with a certain meridian, the exact positions of none of which were at the time known within limits of many miles, was hardly satisfactory.

In connection with this particular frontier, we may further observe that the "shore" of a lake is often liable to great alteration in different seasons and is in many cases too variable a line upon which to hang a frontier definition. This is certainly markedly the case with Lake Chad.

In parenthesis, it may be noted that there are at least four lines joining two points upon the Earth's surface which can with almost equal justice be described as "straight."* The difference in length between these four lines is inconsiderable but the difference in position or maximum deviation one from another is by no means negligible.

In at least one historical instance it has been tacitly assumed that a line ruled upon a map with a straight ruler represents a straight line upon the Earth's surface; whereas it is obvious that the true curvature of such a line will vary with the system of projection of the map. However it does not appear that any ambiguities of this nature have ever given rise to frontier disputes and the point is only mentioned as illustrating the unsuspected difficulties which may trip up the incautious.

While a long length of straight line is not a very good selection for a frontier there is little or no objection to short lengths of such lines as, for instance, would arise if a frontier is taken as running from peak to peak of a mountain range. Provided always that the lines can be beaconed in such a manner that the ordinary native has no excuse for a mistake as to which side of the frontier he is on, a succession of straight lines, being simpler in plan than the watershed line, may sometimes be substituted for it with advantage.

Another class of artificial frontier is that described by reference to existing artificial conditions, such as a frontier defined as following the

* If A and B are the two points, the lines are—

(1) The intersection of the surface with the plane containing A and the normal at B.

(2) The intersection of the surface with the plane containing B and the normal at A.

(3) The "curve of alignment" in which, at any point, a plane can be drawn containing A and B and the normal at the point.

(4) The geodetic, or shortest line between the two points, which is not, in general, coincident for any part of its length with (1), (2), or (3).

limits of occupation of a certain tribe or the boundary of a certain province. The inevitable vagueness of such a description will naturally restrict its use to any but cases where land values are small and where the country is undeveloped or sparsely inhabited. Even in such cases it would almost always be preferable to substitute a more rigorous definition. Thus the long misunderstanding between this country and Portugal as to Barotseland, where we claimed the whole district subject to the king of that country, has been a direct result of the vagueness with which the limits of our claims, depending upon such a shadowy thing as the rule of an African potentate, were presented, both to our own minds and, *à fortiori*, to those of our rivals. As a more recent example of the evil of indefiniteness we may note that at the present moment the Foreign Office would be extremely pleased to be informed what is the true northern limit of the province of Sinai.

In connection with the question of tribal boundaries, more particularly in Africa, there is a further difficulty that arises owing to the fact that tribes and village communities often own outlying patches of land, similar to the detached portions of many British counties. To deviate a frontier so as to enclose all such fragments of land would obviously be impossible so that, to avoid hardship to the natives, the general custom has been to allow them a certain time—say one year—during which they can freely choose on which side of the frontier they wish to live and, when the choice has been made, to give them grants of land as compensation for what they have lost.

A frontier defined as running at a certain minimum distance from an existing road, or skirting an existing town or village, requires no elucidation.

A last class of frontier definition, one that we may hope never to see used in the future, is that which defines it as a line drawn on a certain map. If the map is on a sufficiently large scale and is based upon an accurate survey there is much to be said for this form of definition, but the case is far otherwise when the map is one on a small scale and relates to country imperfectly known or incompletely surveyed. Thus, in the convention between Germany and the Congo State of November 8, 1884, Art. VI. reads, "The German Empire is ready on its part to recognize the frontiers of the territory of the Association and of the new state which is to be created as they are shown in the annexed map." The map was not even published with the treaty but was the same one as that attached to the ninth protocol of the Berlin Conference of 1884–5. It was on a scale of about 150 miles to the inch, and, as may readily be imagined, it was, in the light of our present knowledge of the interior of Africa, very far from being even approximately accurate. It would be impossible to mark out the frontier from it now.

While definition by map alone is generally inadvisable it need hardly be pointed out that the objections to this practice are multiplied

many times when the number of copies of the map is so limited that a complete destruction of them is possible. The "ancient limit" of Egypt was laid down on a map which accompanied the Sultan's firman to successive Khedives and, as far as is known, the sole extant copy of this map was destroyed by Ismail when deposed from the khediviate. In this case there is little doubt from contemporary evidence as to what the ancient limit was, but the absence of any official and authoritative description of it is nevertheless much to be deplored.

Unfortunately the average map has no indication of the reliance to be placed upon its accuracy and in consequence features whose positions are dependent upon travellers' vague reports are often treated as of equal value with those based upon real knowledge and accurate surveys.

The maker of frontiers must keep a clear mind as to the true value of the features with which he is dealing, and thus avoid an error such as was committed when the fine mountain of Kilimanjaro was surrendered to Germany in exchange for the mythical Mfumbiro. When we realize that at the time the treaty was made (1890) Kilimanjaro was quite well known and had been visited by numerous Europeans, while Mfumbiro had only been seen by three white men, none of whom had approached it within 40 miles, the nature of the mistake is evident. Finally, we must remember that once our frontier has been accurately and completely described any redundancy in definition carries with it possibilities of doubt and confusion. Thus the agreement between France and Liberia of December 8, 1892, fixed their mutual boundary from the coast as following "the thalweg of the river Cavally as far as a point situated about 20 miles south of its confluence with the river Fodedougou-Ba at the intersection of the parallel of 6° 30′ N. lat. and the meridian of 9° 12′ W. long." It will be observed that the same point is here located in two totally different ways, first as a point on a certain river, and secondly as the intersection of a named parallel and meridian. Recent surveys, as might naturally have been predicted, have shown that these two definitions are quite inconsistent with each other.

In concluding this lecture, which has, I am afraid, treated the subject in a somewhat inadequate and sketchy manner, I should like again to draw your attention to its national importance. There was a time when Great Britain was not burdened with troubles of land frontiers, except in the case of India and Canada. Now, however, owing chiefly to the partition of Africa among European powers, this happy time has passed and, for good or ill, we are involved in responsibilities from which our insular position long kept us clear. When we remember the fact that we have at this moment in Africa alone about 5000 miles of frontier common with France and 3500 miles common with Germany we cannot be accused of pessimism if we frankly recognize that these long lines, large sections of which traverse

country still almost unexplored, contain the germs of future misunderstandings. To avoid and guard against such misunderstandings is the function of the diplomatist and to aid him in this task he must call to his assistance the scientific geographer or, better still, must himself be the scientific geographer when, relying upon his own knowledge alone, he will be able to uphold the interests of our country and to safeguard the peace of future generations.

A PLEA FOR THE INVESTIGATION OF BIOLOGICAL AND ANTHROPOLOGICAL DISTRIBUTIONS IN MELANESIA.*

By Dr. ALFRED C. HADDON, F.R.S.

THE Melanesian islands constitute a fairly well-marked biological province. Many of the islands are of large size, while most of them have a greater area than the majority of the islands of the Pacific, and there is reason to believe that these are vestiges of an ancient land-mass that probably became submerged in the Mesozoic period. The islands of Melanesia have yet to be studied from a purely geomorphological point of view, and the geology of most of them is practically unknown.

Probably botanists are not satisfied with their knowledge of the flora of the district as a whole, or of particular portions of it; and there must be many problems of plant structure, distribution, and œcology that require detailed investigation on the spot. The same remarks apply to the zoologists. Botanists, zoologists, and general biologists would welcome an opportunity for extensive and intensive study of the morphological, distributional, or biological problems of plants and animals in Melanesia.

There are many anthropological problems in Melanesia that require investigation in the immediate future, since the dying out or modification of arts, crafts, customs, and beliefs that is now taking place, and the shifting and mixing of populations, will soon render their solution difficult or even impossible. On the other hand, there are many districts never yet visited by a white man, and many islands of which science has no ken.

The Melanesians are mainly a dark-skinned, woolly-haired, dolichocephalic people, but there is much variation in these and other physical characters. For example, the skin may be nearly black or of a coppery tinge, the woolly hair may be more or less completely unravelled among certain individuals in many places, and the cephalic index varies from extreme dolichocephaly to well-marked brachycephaly. It is generally

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* Research Department, June 8, 1906.

admitted that this somatic variability is explicable on a theory of Polynesian admixture; but it has yet to be proved whether (to take one character only) the brachycephaly is entirely due to this factor, or whether it is the result of variability in the stock itself, or it may be the expression of a distinct variety of the Melanesian race. The Polynesians themselves are by no means a pure race, and their constituent elements require elucidation. Dr. Volz (Volz, W., 'Beiträge zur Anthropologie der Südsee,' *Archiv für Anthropologie*, 23, 1894) has argued, only from craniological evidence however, that there is a primitive Australian element in the West Pacific and even in New Zealand; and he divides the Melanesian and Polynesian races into several "branches" and "types." The further elucidation of these problems can be effected only by a very large series of physical measurements and observations extending over a wide area.

The psychology of backward peoples has been greatly neglected, and the opportunity of a well-equipped expedition would do much to encourage students to undertake this research.

A good deal is known about the arts and crafts of the Melanesians in a general way, and attempts have been made to synthesize our knowledge, the most satisfactory of these being that of Dr. Gräbner (Gräbner, F., "Kulturkreise und Kulturschichten in Ozeanien," *Zeitschrift für Ethnologie*, 1905, pp. 28–53), who has published half a dozen maps illustrating the distribution of a large number of cultural objects and of certain customs. He distinguishes in Western Oceania a primitive west Melanesian culture, followed by an eastern Melanesian culture; later came the proto-Polynesian culture drift, and finally cultural elements from the southern Polynesians. Generalizations such as these naturally depend for their value upon the accuracy and completeness of the observations upon which they are founded, and a systematic survey of the island groups as a whole would lead to trustworthy results. An investigation of this kind would verify existing data, add an immense number of new facts, and localities could be ascertained for unlocated specimens in our museums, and the uses of doubtful objects could, in many cases, be discovered.

Although data exist for the study of many languages of Melanesia, a great deal remains to be done in the collection and study of fresh matter; and the folk literature has yet to be recorded.

By a combination of these two lines of inquiry, the physical and the cultural, the nature, origin, and distribution of the races and peoples of the West Pacific could be elucidated.

There are other aspects of the anthropology of Melanesia that are of equal importance, to which brief allusion must be made.

The sociology of the Melanesians has been studied by various writers, chief among whom is Dr. Codrington (Codrington, R. H., 'The Melanesians,' Oxford, 1891). We know that mother-right is generally

distributed, but in many places it has been partially or totally replaced by father-right. Melanesia is peculiarly suitable for studying the stages of this transition, and it requires local knowledge to determine whether the passage has taken place spontaneously, or whether it is due to racial influences. If the former be the case, it is important to discover the causes that have led to this transformation and the steps that mark its progress. With this is associated the evolution of the family and the distribution and inheritance of property. Melanesia is also a favourable area for tracing the emergence of government, as all stages occur between the regulation of public affairs by a conclave of elders and the establishment of a powerful chief with more or less autocratic powers. What is required at the present day is intensive studies of restricted areas, but these areas should be carefully selected so as to procure the maximum of results with the least expenditure of time and energy. It is only by careful regional study that the real meaning of institutions and their metamorphoses can be understood.

All the manifold beliefs and usages that are grouped under the term "religion" require detailed local study, and much information is desirable concerning the remarkable development of secret societies in Melanesia.

The study of the decorative art of Melanesia is practically untouched. It is absolutely necessary to make investigations of this nature on the spot in order to discover what is the significance of the various designs and patterns, and to accomplish this in a satisfactory manner it is necessary to have exceptional facilities for getting about.

It is superfluous to extend this plea, as all ethnologists will agree that this work requires to be done, and that without delay, a conclusion which must also be obvious to those who have not previously given attention to the subject. The presence of Government officials, missionaries, traders, and of returned indentured labourers, tends rapidly to modify or destroy the old customs. Much has already disappeared in many places; we are yet in time in many others if we do not delay.

For fifteen years I have been convinced that the best means of accomplishing the end in view is to organize a prolonged expedition to the Pacific with the absolute control of a suitable vessel. The vessel must be a steamer built for comfort and stability rather than for speed. The permanent scientific staff on board should be the director, doctor, photographer, at least two stenographers, who should also be typists, and, if possible, an artist. The director should reside permanently on board, but should he for any reason elect to remain temporarily on shore, he must appoint a deputy, who must remain on the vessel, and during this time the latter is to have full powers and sole control.

Accommodation should be provided for a number of investigators,

but these would not necessarily form part of the permanent staff. They would be conveyed to the district which they were to study, and be removed therefrom when it was time to leave. The director would arrange with each investigator when the vessel would return, and the investigator would be left with all the apparatus, food, and "trade" that he required.

The general routine would be as follows: an anthropological investigator would be expected to work on the general lines laid down by the director, due regard being had to his special aptitudes, and he would be expected to make such arrangements that, when the vessel returned, a large number of natives would be ready to be measured and photographed. While taking photographs himself of anything of a temporary nature, he would not be expected to photograph permanent objects, as the expedition photographer would be put at his disposal on the return of the vessel, the object being, of course, to save the investigator all unnecessary labour. Arrangements should also have been made for dances or ceremonies (actual or rehearsals) to take place during the steamer's visit, in order that they might be adequately photographed and cinematographed. The investigator would orally amplify his rough notes, and dictate them to the stenographers; and, as far as possible, all notes should be typed in duplicate before the departure of the investigator, and a revision made of them before finally leaving the spot. During the time that the steamer was at the district of an investigator, all those on board would be required to help that investigator according to their several abilities. The investigator should inform the director of any tradition of migration, or of trade routes, or other cultural transmission, so that these clues might be followed up by the steamer at the earliest opportunity.

Should there be a student who desires to make a general survey of the distribution of any series of customs or objects, he would naturally remain on board, or be landed for a shorter or longer time, as he desired; special arrangements would have to be made between him and the investigators of special districts.

The foregoing remarks apply to anthropological investigators, but suitable arrangements could be made for geological, meteorological, geographical, botanical, or zoological investigators.

Americans and foreigners should join the expedition on the same terms as British subjects. Investigators might be of either sex.

(An estimate of the probable cost of such an expedition and other practical details were laid before the meeting, but it is not deemed expedient that these should be published just now.)

It is only by an expedition of this kind that the anthropology of Melanesia can be studied in detail and as a whole. It would be an expensive undertaking, but the results obtained would amply justify the expenditure of time, labour, and money, and the data so obtained

would constitute a mine of information for the present and future generations of students of man.

Before the paper, Sir GEORGE GOLDIE: I shall only say a few words. I should like to express my sympathy, personally and generally, with Dr. Haddon's plan. When he suggested it to me, it appealed to me very much, and I think it is in consequence of that conversation that he has brought forward the paper. Geographers quite recognize the functions of geography in such a question. Of course, there are a great number of sciences—biology, anthropology, and so forth—which deal each with its own field and its own special division of the phenomena that occur on the surface of the Earth, but when these sciences come into relationship with each other and with past, present, or probable future land forms or distribution of land and water, geography alone can solve the problem; so that Dr. Haddon's expedition would be, although very technical in its aspect, on the whole a geographical expedition.

After the paper, Dr. HERBERTSON: I have not heard anything of Dr. Haddon's proposals until this afternoon, and it is rather difficult to say anything very much to the point on the spur of the moment. One has only to look at that great depth of ocean lying to the east of New Zealand to see that there must be fascinating problems in this Melanesian area; and doubtless what one has read about the changes of coast-lines in works such as those of Prof. Agassiz in dealing with the islands of the Pacific, and books like Guppy's, points to the fact that very much valuable work has to be done in this region before we can come to decided opinions as to its past. And from that geomorphological point of view, I think such an expedition would give rise to excellent results.

Mr. CHISHOLM: All I can say is, I have not the slightest doubt that such an expedition as this would certainly lead to valuable results, and I express the hope that Dr. Haddon will be successful in raising the money for the purpose.

Dr. SELIGMANN: In reference to what Dr. Haddon said about undeveloped government in Melanesia, I believe that we may have a condition of government even lower than that by the old men of the village. It was very forcibly borne in on me that at times the old men only voiced the opinion of the community, and if they tried to influence it to any considerable extent, they would have been disregarded; I do not say no notice would have been taken of their advice, but it would not have been acted upon—things would have come to a deadlock, and this has happened once or twice. With regard to the vessel that Dr. Haddon spoke of, it must be remembered that no vessel is ideal for the Pacific, every vessel draws a foot more water than is possible for somewhere you want to go. It will be a necessary thing to get the smallest possible draught which is compatible with stability. On the recent Daniel's expedition we found a paraffin-launch of immense success. We were on a sailing-boat, and what I saw of it fully persuaded me that a steamer was the only thing. Even working a small district of islands, we came to the conclusion that a steamer would have been far more valuable than a sailing-boat; and certainly, if I ever went on another expedition, I should try for a steamer, even if I had to pay £5 a ton for coal dumped on the beaches. I was also struck with what Dr. Haddon said about the value of women, and that no one had studied the women's customs from the women's standpoint. This opens up another difficulty, and that is interpreting. I have never found any New Guinea woman, with the very partial exception of native wives of traders, who would have been able to translate into English. I should think that was a possible difficulty, and it is difficult to see how it could be even partially met. As regards what might be expected zoologically in the way of new

specimens, I think a very great many new things would be found. I may give you one particular instance. We were in no sense a zoological expedition, but when we collected a few specimens of fish simply to have them identified, because they were tokens, and some of them turned out to be new species. I should finally like to heartily express my sympathy with Dr. Haddon's idea, and the hope that he will be able to carry the scheme through.

Mr. MYRES: I should like to mention one or two points. The first is the very great desirability of carrying out such an expedition before it is too late; the second point is, if such an expedition should take place it should be arranged so as to interest a large number of people in it, and so as to ensure that the material collected would illustrate not merely the nature of the native races of the area, but at the same time the physical environment in which those races and their culture have come to be what they are. The other thing I should like to mention is that the area that Dr. Haddon proposes seems to be eminently suitable for the purpose, and even if his estimate were to be considerably exceeded, as such estimates are always liable to be, a sum of anything between £60,000 and £100,000 would undoubtedly be regarded, a hundred years hence, as having been well spent.

Mr. RAY: I was very much interested in Dr. Haddon's paper. I may say I am in full sympathy with Dr. Haddon in regard to his proposal for such an expedition, but one of the difficulties is the question of interpretation. The missionaries learn the languages to a certain extent, far enough to be able to produce a gospel translation, and when that is published they rarely go any further. Very few of them take down native stories, and no native literature is preserved.

Mr. THOMAS: Although I have no practical experience of expeditions, I am sure I very strongly agree with Mr. Ray in what he says with regard to the importance of language, but if the expedition is to last as long as five years, it seems to me the question of the absence of interpreters would be to some extent got over. I imagine the investigators would have acquired the language and be able to act as their own interpreters long before the termination of the expedition. Dr. Haddon did not say anything about the destination of the collections. I think that they should all be collected together in one building and be accessible to students. I am especially interested in social organization and questions of that sort, but I really do not think that any anthropologist can have the slightest doubt of the importance of such an expedition, and of the extreme importance that such an expedition should go early rather than late. To take the example of Australia. The extent to which European influence spreads is probably very much underestimated. Now, in the north-west of Australia there are areas where probably no white men have ever been, but right through these areas, instead of natives using the stone implements which they formerly used, the first expedition found that they possessed iron implements. That illustration alone shows how quickly European influence makes itself felt; and in the same way customs become merged and many other details of social organization are liable to be influenced, when Europeans have been only comparatively slightly in touch with the people. That applies, of course, to many other parts of the world besides Melanesia. It seems to me that, for anthropological purposes, it is of great importance that such an expedition as this for the detailed study of such questions should set out as early as possible.

Captain WILSON-BARKER: There is very little I can say about Dr. Haddon's paper. I quite think that such an expedition would be extremely useful and extremely valuable, because there are many other sciences that might be included in the expedition than Dr. Haddon has alluded to. I need hardly say we want a lot of oceanographical and meteorological information from that part of the world. It is

a region of the world, meteorologically speaking, which is a monsoonal region, and I think very little of it has been investigated as regards the storms and the general meteorological conditions. With regard to the vessel, I think there would be no difficulty about getting a suitable one. The draught of water is always rather a difficulty. I quite sympathize with Dr. Haddon and the other gentlemen who spoke about the draught; that very often is a difficulty. Of course you could have a motor launch, and then go almost anywhere you liked. It would be quite possible to get a suitable vessel for going about in that way at, comparatively speaking, a small cost.

Major DARWIN: I should like to say how warmly I should wish to support this proposal of an expedition by Dr. Haddon. I am reminded of a story which is perhaps not inappropriate. It is of the very best business man I ever knew in my life. He made a vast fortune, and I asked him one day what was the secret of his success. He said, "I found my man first, and my job afterwards." We have Dr. Haddon, and he ought to be employed on an expedition of this sort. There is only one other point I should like to make. We have heard something of the difficulties, and they are, no doubt, great; but I should like to ask Dr. Haddon if he does not think that the difficulties will increase as the time goes on, rather than decrease? And if the difficulties are likely to increase, then they seem to me to be absolutely no argument whatever against attempting this expedition.

Colonel CHURCH: I do not think that I can say anything of any value to-day, except to give my very hearty approval to the idea of such an expedition.

The CHAIRMAN (Sir THOMAS HOLDICH): Before asking Dr. Haddon to reply to some of the points which have been raised in the course of the discussion, I should just like to ask him one question. The anthropological point of view is the one naturally which he has emphasized most in his plea for this expedition. I should like to know whether he considers, from information which he has already obtained —because perhaps he is better acquainted with that part of the world than most anthropologists—whether he considers that the tribe of Melanesian people as a whole are diminishing in numbers or increasing; that is to say, can they wait, or should their sociology and their evolution all be investigated at once? Because there are parts of the world where the aboriginal people are rapidly disappearing; I may particularly mention Patagonia—where in the course of another ten or twelve years we may confidently expect that some of the tribes will have disappeared absolutely, and there will be no further opportunity of investigating their manners and customs. That is the only point I should like information upon. Now I will ask Dr. Haddon to reply to some of the points raised in the discussion.

Dr. HADDON: First of all, sir, with regard to your point, I do not know that the people are actually disappearing to any great extent from most of the islands, but owing to the Government and the trader and the missionary and the indentured labourer, who is coming back from Queensland and elsewhere, native customs and beliefs are getting terribly upset. Your point is one I am particularly keen about. We should look at all these things from a business point of view, and not do merely what is worth doing, but what is most worth doing at the present moment. I think, on the whole, one is quite justified in regarding Melanesia as a field that ought to be studied immediately. Of late years one so constantly hears people say, "Why don't you send an expedition to this place or that place; the people are all dying off?" If we did that, we should have to send expeditions over the whole world, and it is impossible to do that. I am interested in Melanesia, and one can only work in the corner one knows about or is most interested in. I may say that of course I have considered very carefully the *personnel* of an expedition of this sort, but that is a matter for future discussion. Captain Wilson-Barker has already

met Dr. Seligmann's difficulty of the depth of the steamer, as a motor launch could go anywhere. Mr. Ray spoke about the difficulty of the language. Well, he states that some missionaries only imperfectly know the languages, and he says they are not improving in this direction. Well, what are we going to wait for? How are we going to know these languages? I am quite certain if we wait till we know more about the languages we shall never do anything at all. As to accuracy, accuracy depends upon the investigator and the spirit of the investigator. You can get accurate information from very imperfect material if you go the right way to work. I am aware of these difficulties, but the job has to be done, and the difficulties do not lessen by time; it will become more and more difficult, and the sooner we do it the easier it will be.

Mr. Thomas spoke about the collections; their destination must depend upon the source from which the money comes. If there are collectors of all nationalities, as I hope there will be, each man who works a particular area will necessarily require specimens for his country; and I think the way out of the difficulty would be that the expedition has the first claim on all the specimens, and when the expedition is finished with them, the second set of specimens might go to the countries of the investigators. That seems to me to be the only practical way. With regard to what Captain Wilson-Barker said on the question of oceanology and meteorology, the expedition would welcome any one who would come and do scientific work, only it could not undertake to do much surveying work, as men's lives and healths are at stake, and the work of the vessel must necessarily depend upon the exigencies of the individuals connected with the expedition. But apart from that, such an expedition as the one proposed would be only too pleased to advance any science that it possibly could. Of course, as Major Darwin said, there are always difficulties, and the difficulties will naturally increase with time. I think I have gone into most of the suggestions that have been made. Personally, I feel convinced that it is a necessary thing to do, and I also feel convinced that it should be done immediately.

The CHAIRMAN: I think Dr. Haddon may rest satisfied that he has carried the meeting entirely with him in considering that he has amply justified his plea for an expedition to Melanesia. Apart from the question of anthropology, I understand there may be uncharted islands in that part of the world which will give the expedition at once a geographical interest; but geology, botany, and even, as Captain Wilson-Barker has suggested, meteorology and oceanography, are all surely more or less within the scope of an expedition of this character. Whilst we all of us wish him all success in his scheme, I think at present we can do no more than thank him for giving us a very interesting paper and raising a useful discussion.

The following letter has been addressed to Dr. Haddon by the President, Sir George Taubman Goldie :—

"Royal Geographical Society, 1, Savile Row, W.

"DEAR DR. HADDON,

"I have brought to the notice of the Council of the R.G.S. your proposal to lead an expedition to Melanesia, put forward by you in your recent address to our Research Department, and I am desired to say that they fully recognize the immediate importance of the work which you are willing to undertake, as well as your undoubted and exceptional qualifications to assume charge of such an expedition.

"The funds of the Society do not at present admit of their giving financial assistance, nor indeed have you suggested that they should do so, but you have the warmest wishes of the Society for your success in obtaining the necessary funds.

"Yours sincerely,

"(Signed) G. T. GOLDIE.

"June 11, 1906."

NOTES TO ACCOMPANY LIEUT.-COLONEL MAUNSELL'S MAP OF EASTERN TURKEY IN ASIA.*

IN Oriental countries there are many obvious difficulties in the way of detailed or accurate surveys, and maps have therefore to be compiled from reconnaissance work and less perfect data than in countries whose Governments themselves undertake the surveys. A great deal can be done by fixing positions with a 6-inch sextant and half-chronometer watch, which can be utilized to check the ordinary reconnaissance done by compass and time distance.

In the western portion of Turkey in Asia many of the large towns have been fixed sufficiently accurately by previous travellers and surveys, and further observations tend to show their positions are very closely correct. Sivas, Erzingan, Kharput, Malatia, Karahissar, and Tokat are instances of this; further positions were fixed in relation to these, and reconnaissance work undertaken through the lesser-known parts of the country. In the Sivas district and in the Taurus ranges much work was done by Sir Charles Wilson and the military officers under him in 1881, and this has been utilized. The Black sea coast districts are very mountainous and intricate for survey work. The actual coast-line can be obtained from the Admiralty charts, and inland as far as the coast ranges—some 40 or 50 miles—work has been obtained from mining engineers and others engaged in the construction of new roads inland. The intricate country of the Dersim, in the bend of the Euphrates below Erzingan, has been filled in from surveys by the late Sir Herbert Stewart, with some recent additions.

The Russian survey, 5 versts to an inch, of the Trans-Caucasus Province has been utilized for all the frontier districts about Erzerum, Alashgird, and Bayazid, which were surveyed during the occupation at the close of the 1878 war. For the country round Lake Van, the principle of fixing points by latitude and azimuth was utilized as far as possible, the prominent peak of Ararat, already fixed on the Russian survey, and lying nearly north of Van, being found most useful. A base line for a triangulation was roughly measured by the same means. The latitude of Van Consulate was observed and its position fixed by an azimuth to Ararat, this forming one end of the base. The summit of

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* Map, p. 208.

the Pir Reshid Dagh, some 40 miles to the north, was fixed in a similar manner, and formed the other end of the base.

Many prominent peaks could be fixed from this base—the great cone of Sipan Dagh north of the lake, Varak Dagh over Van town, and several points in the high ranges south of the lake, and even the Maratokh Dagh, far away beyond Bitlis, also, such is the extraordinary clearness of the air on this elevated plateau.

By using a large prismatic compass, an approximate triangulation was thus begun and systematically extended, principally south-westwards to Diarbekr, which town was ultimately fixed, and also southwards into Hekkiari, the Bohtan district, and the wild country round the headwaters of the Great Zab. The sextant and chronometer was also utilized to fix positions, in support of the triangulation, Van being treated as a fixed point.

To fill in the detail of the country between the points thus fixed, a network of reconnaissance surveys was undertaken and the blanks gradually filled up. The country round the basin of the upper waters of the Great Zab, the Nestorian Christian country, and the valley of the Bohtan, all mountainous districts in which scarcely any survey work had been done since Layard's time, have now been filled in to a great extent, although gaps still exist.

Much new work has also been done in the country between Diarbekr and Bitlis, and it is curious that this open country between the foot of the hills and the Tigris has been hitherto so imperfectly mapped.

The upper and middle courses of the Batman river, the largest tributary of the Tigris, sometimes containing as much water as the parent stream itself, have now been traced, and the three streams which rise in the mountains of Sassun and combine to form the Batman have been defined.

Probably the difficulty hitherto experienced in tracing the course of these streams lies in the fact that before entering the Tigris plain they have to force their way through an extremely narrow deep rift in a limestone plateau; the junction of two of the more important streams takes place here, and the rivers, although containing a great volume of water, are almost lost to view as they traverse the plateau, and it is not until the very edge of the rift is reached that it can be discerned at all. All this country north-east of Diarbekr would well repay detailed study, and it has many ancient inscriptions and remains awaiting examination.

The rocky districts of the Tor Abdin, near Mardin, as well as much of the Hekkiari country on the other bank of the Tigris, is from reconnaissances by Sir Herbert Chermside.

The country round Kharput and Lake Geuljik, as well as the great gorges of the Euphrates below Kharput, are from Mr. Ellsworth Huntingdon's surveys.

The country along the Turko-Persian frontier is taken from the

detailed surveys made by a joint commission many years ago, which extended over a strip of country along the supposed frontier, but never actually delimitated it. All the country along the lesser Zab in its middle and lower portions is new, and is the result of several reconnaissances and a raft journey down the river. Some positions were fixed here also by sextant and chronometer lent by the Society. More recent work in the Kurdish hills and Tigris plain, by Captain Mark Sykes, has also been included.

The expanse of desert round Baghdad, with its ancient remains and traces of the many canals which formerly fertilized the country, is from the surveys made at the close of Chesney's expedition to that part of the country, and which still very accurately represent the ground.

F. R. M.

THE SURVEY OF INDIA.*

A GREAT deal that is contained in the Survey of India report for 1903–4 might almost be called ancient history, so long has this report been delayed in publication. It is chiefly interesting when read by the light of subsequent recommendations made by the special committee which was convened to inquire into questions of Survey administration, and which has proposed certain radical reforms. That committee concerned itself mainly with the question of maintaining an accurate and up-to-date topographical map of India and of the Indian border, and in relegating cadastral or fiscal surveys to local centres of civil administration. It is therefore interesting to observe, from the map illustrating the progress of imperial surveys, that there is really very little of the Indian peninsula left to map topographically, that little being a section of Rajputana desert. The province of Madras also exhibits certain blanks, but this is because the completed Madras surveys are not reckoned as imperial. The future *rôle* of the Indian Survey (apart from the scientific work of the department) will be that of constant revision and improvement in existing topographical mapping, ample provision having been made for the extension on larger scales of the existing geographical mapping of trans-frontier regions.

The total outturn of detail survey for the year under review amounts to 58,464 square miles, including 24,100 square miles of geographical surveys, under which latter heading are included 6000 square miles of the Aden mission under Colonel Wahab; 35,000 square miles of the Seistan mission under Sir H. MacMahon; and 18,000 square miles of Tibet between British territory and Lhasa. Another 40,000 square miles was, however, added by Major Ryder on his return journey from Lhasa

* 'General Report of the Survey of India, 1903–4.' Serial No. 9. Professional Papers, Survey of India. Report on United States Surveys.

to India *viâ* Shigatse and Gartok. This is an addition to our geographical knowledge of which Colonel Gore, R.E. (late Surveyor-General), may well be proud. Beyond the ordinary details of satisfactory progress in the topographical, forest, and cadastral branches of the department, together with an account of the work of the map-producing offices, this report is notable for two or three unusually interesting chapters. We have, firstly, a record by Captain Tandy, R.E. (the only one published, as far as we know), of the strenuous work of the Aden party, dealing with a part of Southern Arabia on the borderland between Turkish and British domination, which illustrates, not only a geographical region which is absolutely new to anything like scientific survey, but incidentally shows what may be expected from Turkey in negotiating boundary questions if British claims are not properly backed up by force. Then there is the narrative report of Major Ryder, R.E., on his Tibetan surveys and explorations, covering another large area of country which has hitherto been known to us only from the researches of Indian native explorers, of whose work, by the way, Major Ryder speaks very highly. Next we find another new and most important geographical record in the only topographical map of Nepal that has ever been published, showing the conformation of the mountains in a wide section of the Himalayan system. This is the work of Captain Wood, R.E., who claims the proud distinction of being the first English surveyor who has been permitted to take observations in Nepal. It is a most valuable document, for it sets at rest the disputes which have arisen about the position of Mount Everest, proving that peak to be far removed from others which have been confused with it, and placing them all in their true relative positions. It also indicates that the great snowy range of the Central Himalaya (sometimes mistakenly called the Indian watershed) possesses no continuity through the width of Nepal from west to east. The group of mountains of which Everest forms the centre, and the contiguous group dominated by the peaks known as Gaurisankar, at any rate, form no part of it. The position of certain passes leading into Tibet north of Katmandu can now be located with a fair approximation to exactness, even if we do not know much more of those leading from India to Katmandu than we knew before. A series of admirable profiles of the Nepalese hill ranges adds greatly to the interest of this report. Finally, we have, in addition to the detailed account of the scientific work of the department and the progress made in principal triangulation (which is at present restricted to the Salween series in Burma) in astronomical, pendulum, tidal, levelling, and magnetic investigations, a most admirable note by Lieut.-Colonel Burrard, R.E., F.R.S., on the value of the scientific branches of survey operations. If any *apologia* for the State maintenance of such branches of the department were necessary, Colonel Burrard's treatise (which is also issued in independent form)

would surely set at rest the criticisms of the most strenuous financial reductionist. The clearness and directness of Colonel Burrard's remarks appeal to the unscientific as well as to the scientific reader. The booklet deserves a far wider circulation than is to be found in the official ring of Indian public opinion. In it we have the true relationship between the scientific and the practical in survey matters clearly defined. They are absolutely inter-dependent. Practical work must have a scientific basis; scientific work is useless except in relation to practical results. Geodetic measurements of the highest class are as necessary for topographical purposes as for mathematical deductions dealing with the dimensions and figure of the Earth. "Areas" and not "arcs," we are reminded, are the best basis for such deductions. This is perhaps not altogether new, but it is a most valuable reminder at the present time. The bearing of astronomical observation on Earth-measurement, and of investigations into the variations in the force of gravity; the value of accurate levelling and the errors induced by the neglect of it; the importance of registering tidal fluctuations and the phenomena of Earth magnetism, are all impressed upon us in plain and untechnical language such as "he who runs may read." Incidentally we learn something of the relative value of the triangulations of different countries, and it is satisfactory to note that, judged by the standard of precision in relation to length, the triangulation of England is only surpassed in accuracy by that of Russia and India. The triangulations of France and Prussia figure lowest on the list, and may be regarded as level with those of South Africa and the United States. This will be a surprise to those who have looked to the latest methods and modern improvements as sure indications of superior results. Probable errors induced by various factors (notably refraction) in determining altitudes may also alter some of our accepted theories on the relative heights of mountains. It is probable, for instance, that Mount Everest is higher by 140 feet than the height (29,000 feet) at present assigned to it, and that we shall eventually find that Kanchinjanga, and not K^2 (Godwin Austen), holds second place in the world's altitudes.

These are matters which will not particularly affect the world's geography, but the displacement on the Earth's surface of many points supposed to be unalterably fixed, due to the deformation of the Earth's figure, may have a very practical issue when the surveys of adjoining countries and the boundaries between them are co-ordinated. Much scientific work, however, remains to be done both in India and elsewhere before it is worth while to formulate final corrections.

In a separate volume to the Indian Survey Report we have a report by Colonel Waterhouse on the United States Surveys. It is a useful compilation, dealing chiefly with methods and instruments which are well worth study, but not adding greatly to our previous information concerning the actual surveys in existence in North America, or their

objects. Many a useful hint might be taken from American methods. For instance, we learn that under those most difficult of all conditions, where principal triangulation has to be extended through forest-covered country, a system of "double" towers has been devised by our ingenious cousins, from the summits of which observations can be taken without involving the enormous expense of line clearing. These towers are built of "sawed timber," and so expert are the American linesmen at erecting them that it took only seven men to erect seventy of such towers (they are removable, and can be utilized at frequent points) in less than seven months. The towers averaged 42 feet in height. It is in matters affecting economy of labour that the Americans can give points to the surveyors of most countries; in all the familiar applications of the best-known instruments for base measurement, for observing, or for map-making, they adopt the methods usually recognized as most efficient in India. It is rather significant that the art of phototopography occupies but little space in the report, whilst, on the other hand, the use of the plane-table appears to be extending.

T. H. H

RECENT RESEARCH ON LAKE CHAD.

The more or less effective occupation of the shores of Lake Chad by the three Powers whose spheres touch its waters, has resulted in important additions to our knowledge of its geographical features, some of which have already been alluded to in the *Journal*. The work of the surveyors employed by Colonel Destenave, after the arrival of the French on the southern and eastern shores of the lake, gave the first approximately correct idea of its present extent and general configuration, which subsequent more minute surveys have not seriously modified. But the lake possesses so singular a character in many respects, and the question of its recent history presents so interesting a problem, that the fresh observations which have been for some time accumulating are only to be welcomed by geographers, while they still leave room for further study before all the uncertainties connected with the past and present character of the lake can be considered as done away with. On some points of detail the statements of different observers are not quite easy to reconcile.

Of the many officers, especially French, whose work has contributed to the general result, none perhaps possesses a more intimate knowledge of the lake than Lieut. Audoin, who presented his observations in a generalized form in *La Géographie* for November last. This naval officer, who had already done much good survey work among the labyrinth of islands and channels of the eastern side, besides effecting a complete circumnavigation of the lake, was named as one of the chief coadjutors of Captain Tilho, when, on the conclusion of the work of the Anglo-French boundary commission under Colonel Elliot and Commandant Moll, he was charged with the execution of a complete survey. Captain Tilho has given an account of his work in the March number of *La Géographie* for the present year, which contains an elaborate large-scale map of the lake, embodying the results of all the surveys accomplished up to date. The Germans, whose territory touches Lake Chad only in the south-west corner, have naturally had fewer opportunities for study of the lake as a whole; but a useful *résumé* of the

history of its investigation, from the time of Denham onwards, has been contributed to the *Mitteilungen aus den Deutschen Schutzgebieten* (1905, part 4) by Lieut. Marquardsen, a member of the German section of the commission for the survey of the boundary between the Kamerun and Northern Nigeria. This writer, by combining his own observations with those of his predecessors, presents an instructive view of the general character of the lake, though, as his personal acquaintance with it seems limited to the western and south-western shores, some of his generalizations, based in part on earlier work, may need modification. The painstaking survey of the Alexander-Gosling expedition has already been put before readers of the *Journal*, so far as its results are available, and it, too, is an important help to a knowledge of the present hydrographical conditions.

One of the elementary questions to be solved is that of the actual limits of the lake proper, both at low and high water, but this is complicated by the apparently rapid changes to which it is at present subject, both from season to season and from year to year. The view held by Lenfant and others, that it is rapidly drying up, is shared by Lieut. Audoin, while Captain Tilho also believes that great changes have taken place since Nachtigal's time. That these are still in progress seems shown by the fact that Lieut. Alexander found an almost impassable barrier of vegetation stretching across the open water shown on the earlier French maps as running down the west side. It is unlikely that this barrier can exist only at low water, and Captain Tilho found a distinct tendency for the northern and south-eastern basins to become separated by the progressive formation of sand-banks and the growth of vegetation on them. It is possible that too much trust may be placed on early maps as indications of the state of things during the middle and end of last century, for even Nachtigal's acquaintance with the lake was insufficient to enable him to show its limits with more than an extremely rough approximation, while he recognized that a large part of its area was taken up by the islands of the Budduma, and that at low water but a small part of the whole was covered. In any case, there seems no doubt that any extension of the banks and islands causes a net diminution of the water area, and not a mere displacement from east to west, as has sometimes been thought possible, for it is certain that the western shore-line, which is the best-marked of the whole, has not shifted west as a result of growth of land on the east.

With regard to the supposed difficulty of fixing the precise boundary-line between lake and land, Lieut. Marquardsen says that it has been exaggerated, as the normal high-water line is well marked by a belt of vegetation, and even in dry seasons only the outer fringe of this is killed by the drought. The apparent difficulty occurs chiefly, not at the period of high water, which is some time after the bulk of the rains is over, but during the rains themselves, when all the depressed portions of the surrounding country are filled with rain-water, which has really nothing to do with the lake. This would explain the ease with which an exaggerated notion of the extent of the latter may have been formed by the earlier explorers. Still, the evidence of a net diminution in the past few years seems incontrovertible. Lieut. Audoin, who gives an excellent description of the archipelago of islands on the east side, and the varying nature of these as one progresses farther from the permanent shore, says that islands not long ago distinct have now coalesced, and that the different names borne by parts of the same island are survivals from a former state of things. The regular arrangement of the islands and intervening channels in lines at right angles to the direction of the north-easterly winds proves the former to be of the nature of dunes, which have encroached upon the lake. This character is, indeed, taken by Lieut. Marquardsen as a proof that the eastern portion of the lake occupies what was once part of the

desert, but he does not seem to allow sufficiently for the rapid advance of the dunes in the direction of the wind, which would enable them to invade the old lake-floor during dry years and in the dry season.

Lieut. Audoin makes an attempt to elucidate by mathematical calculations the existing hydrographical conditions. His figures are based on observations extending over some time, but the hypothetical element seems too large to justify very full confidence in the results. In a mean year he calculates the gross amount of water-supply to the lake as 15,768,000,000 cubic metres, which, on the assumption that the total area is 17,000 square kilometres (the other writers place it at 20,000 or more), would cause a rise of level (were none lost by evaporation or infiltration) of 1·40 metre. About half of the supply only is received during the period of the rise, within which same period the loss is calculated to bring about a vertical fall of 0·15 metre, so that the net rise while the waters continue to mount is placed at only 0·55 metre. The net loss during the rest of the year is placed at 0·70 metre, so that the conclusion arrived at is that on the whole year there is at present a net loss of 0·15 metre. Lieut. Audoin says that these suppositions are borne out by observations and by the statements of natives, but still more extended researches are certainly necessary (as he himself allows) before the conclusions can be regarded as definitely established.

In any case, it is impossible to decide, from existing data, whether the apparent desiccation is continuously progressive or whether we have to do merely with periodical fluctuations. That the latter may be the case is the conclusion drawn by Captain Tilho from the statement of a native chief, who showed Captain Hardellet various lagoons then full of water, but which his father, when a boy, had seen dry. "All these lands," he said, "were then Kanem; afterwards Allah sent great rains, the waters rose, and Kanem retreated far to the north."

Lieut. Audoin regards the drying up of the Bahr-el-Ghazal as possibly a consequence of that of the lake as a whole. He thinks, however, that even when it existed it may have been nothing more, at least in its western part, than a series of lagoons similar to those on the Kanem shore, and that the motion of the water was merely a surface current varying with the direction of the wind, such as may be observed in many of the channels of the lake. Captain Tilho does not venture a theory as to the character of the Bhar-el-Ghazal, though believing, with Nachtigal, that the lake water may be drained away long distances by underground channels.

Among the many interesting points discussed is that of the colour and composition of the lake water. While Lieut. Marquardsen (judging, it seems, from his experience in the south) says that it is fresh, Captain Tilho maintains that this is by no means the case except near the mouths of the two principal rivers. At a distance from these, *e.g.* in the stagnant lagoons of the archipelagoes, it is sometimes so charged with salts that even cattle refuse to drink it. However, by digging a pit near the borders of the lagoons, potable though slightly brackish water may be obtained. In the case of other swamps in this region, it is often found that the water in the centre is the most saturated with salts, which, on the drying up of the swamps, are deposited in the order of their crystallization, those rich in chloride of sodium occupying the periphery, while a deposit of natron will be found in the centre. In portions of the lake a regular gradation of colour from within outwards may be noticed, passing from grey through yellow to bright green and blue. Full information is given on the *régime* of the winds in the basin of the lake, the variations of the seasons, and the like. The changes of level, which have been thought to partake of the nature of a tide, are brought about simply by the agency of the winds, their periodicity being due either to the diurnal change in the direction of the wind (noticeable during the prevalence of the north-east winds) or to its

variation in intensity. Where the shore is flat the amount of fluctuation may reach as much as 10 to 15 centimetres (4 to 6 inches), and the water may encroach considerably on the land. Besides the hydrographical observations some excellent survey work on the lake-shores has been carried out, and the methods are described in detail by the several writers, but into these limits of space forbid us to enter.

EARTHQUAKE ORIGINS.

One of the most suggestive contributions which have been made to the understanding of earthquakes has come from an unexpected quarter. In a series of articles, published in Prof. Gerland's *Beitrage zur Geophysik*,* Major E. G. Harboe, of Copenhagen, has developed a new and almost revolutionary notion of earthquake origins. Without going back to the very earliest seismology, it may be said that when an earthquake was first recognized as due to wave motion, propagated outwards from an origin, this origin was regarded as restricted in size, comparable to a point, and called a centrum, or centre. From this was derived the term epicentre, a word which is still used to define the surface immediately over the focus or origin of an earthquake; and though its inventor, Robert Mallet, showed that the origin of the Neapolitan earthquake of 1857 was a fissure, and the epicentre, consequently, an area of some size, yet the idea that both focus and epicentre of great earthquakes are small, in comparison with the area over which the shock is felt, remained. This idea was supported by the fact that there was always a central area of maximum violence, the pleistoseismic area, and from this outwards the violence gradually diminished in every direction, so that the isoseismals, or lines of equal violence, formed a fairly regular series of ovals. In no case was the actual course of an isoseismal free from irregularity, but as it was found that the violence of the shock depended to a great extent on local variations in the configuration of the ground, and to a greater degree on the nature of the underlying rock or subsoil, we had come to look on the diminishing violence of the shock as due to the dissipation of its energy as the disturbance spread out over a continuously increasing area.

There has, however, always been one great difficulty in the application of this interpretation, in the impossibility of getting any sort of agreement between the course of the isoseismal and coseismal lines, the latter being lines of simultaneous arrival of the shock. Exact agreement is not to be looked for, both being more or less influenced by the nature of the rock through which the earthquake travels, but an approximate coincidence there should be if the disturbance travels outwards from a central origin. Seismologists have cut this Gordian knot by rejecting as bad all those time records which do not fit in with the accepted explanation, and there was justification in this, for it has been found that little dependence can be placed on most of the supposed times of arrival, since records from one and the same place usually vary by many minutes; yet it went against the grain to reject, as worthless, observations which bore every appearance of having been made with care, just because they did not fit in with preconceived notions, and Major Harboe's interpretation, if accepted, relieves us from this necessity.

Basing his conclusions on a study of those great earthquakes of which fairly complete accounts have been published, and using the times at which they are said to have reached different places, he has come to the conclusion that the dimensions of the seismic area and of the focus do not differ very largely, and that

* Vol. 4, 1901, pp. 406–420; 5, 1902, pp. 206–238; 6, 1903, pp. 309–348; 7, 1905, pp. 379–410.

the latter consists of a set of fissures, along which the disturbance either originated simultaneously or spread with great rapidity, and from which the wave motion was propagated outwards. In this way he explains the very divergent estimates of the rate of propagation of earthquakes, for it is evident that if two places are both situated on one of the lines of origin, the difference in time between them gives the rate at which the disturbance has spread along the origin; if they are both on a straight line at right angles to this, the difference gives the rate at which the wave motion is propagated, and in every other case we have a combination of the two. The rate at which the disturbance spreads along the origin appears to be subject to great variation, and is usually high, but the rate of propagation of the wave motion seems to be much the same in every case, and is estimated at about five-twelfths of a kilometre, or about one-quarter of a mile, per second.

One of the greatest difficulties in the way of accepting this explanation has been the apparently conclusive results of the 'seismic triangulation' near Tokio, from which Prof. Imamura obtained, in 1902, a mean rate of propagation of 3·18 ± 0·05 km. per second. In his last published paper Major Harboe deals with this, noticing that only eight earthquakes in all are utilized, of which four gave usable seismograms at all four stations, three at only three stations, and one at but two. For two of these detailed records have been published of the times at which they reached the meteorological stations of Japan, and it is shown that these times cannot be made to fit in with the rate and direction of propagation deduced from the triangulation. Interpreted on Major Harboe's lines, it appears that in each case a branch of the origin passed through the triangle of stations near Tokio, so that the times at which the disturbance affected each of the stations do not refer to a single system of wave motion, travelling across the field of observation, but to two distinct sets of waves, spreading outwards from a common origin; on this interpretation the records from the meteorological observatories fall into line, and the discrepancies between the observed and calculated times are minimized.

We cannot say that Major Harboe has proved his thesis, but it must be confessed that he has impugned the title of the current explanation to general acceptance. The old theory must be put on its defence, and the decision between the two be left to future investigators of coming earthquakes, for the investigations of the past have been carried on so exclusively in the light of a single hypothesis that many facts must necessarily have been overlooked, which will stand out prominently in the light of the new interpretation.

R. D. O.

REVIEWS.

AFRICA.

The Problem of South Africa.

'The Africander Land.' By Archibald R. Colquhoun. London: John Murray. 1906. Pp. xv., 438. *With Maps.*

It is hardly possible to review this interesting book as a geographical work. It is, in fact, a treatise on the unsolved political problem of South Africa, in which the author bases his statement of the manifold difficulties of the case, together with his suggested solutions of them, upon the personal observations for which he has had peculiar opportunities. He challenges geographical criticism at the outset, however, by his desire to apply the term "Africander" alike to the British and Dutch inhabitants, instead of to the latter only, and to coin the name "Africanderland" for the territory of a "South African nation." The book has a further

geographical claim in the presence of certain simple, but satisfactory, coloured maps, of a character met with too infrequently in works of this kind. They include even a physical map, the introduction of which, though it may have little direct connection with the actual words of the text, must always be laudable. The presence of this map especially, out of the series, points to the group of geographers to whom the book will be of chief interest, namely, those who have already an intimate knowledge of South Africa. For these the maps will serve to keep their previous knowledge clear in their minds while they graft upon it the peculiar economic and administrative difficulties which are so clearly set forth in the text. Mr. Colquhoun's historical facts, his remarks on the ethnographical distinction between South African races, both white and coloured, are adduced, one might almost say, incidentally, as things familiar to his reader. If they are so, then the reader will appreciate a statement of arguments which, while not seeking to be impartial, is studiously moderate.

AMERICA.

Central Plains of the United States.

'Preliminary Report on the Geology and Underground Water Resources of the Central Great Plains.' (U.S. Geol. Survey, Professional Paper, No. 32.) By N. H. Darton. Washington: 1905.

The report covers an area of about half a million square miles, comprising the greater part of South Dakota, Nebraska, and Kansas, with the eastern portions of Colorado and Wyoming. It is a region in which the present water-supply is insufficient even for domestic purposes, and hence the great interest and importance of the question of the underground resources. The great central plain of North America, having been subject to no folding movements, presents a general tabular surface, traversed by broad shallow rivers flowing from the Rocky mountains, and cut up by the narrower, deeper valleys of the lateral drainage. The surface of the area under consideration is mainly covered by the late Tertiary deposits of Miocene and Pliocene age, laid down in thin but extensive beds of sands and clays on the relatively smooth foundation of the older rocks. These consist of an almost regular succession of the earlier sedimentary strata right down to Middle Cambrian, sandstone of that age, underlying nearly the whole area of the central plains. Various layers of porous rock alternate with sheets of impermeable shales or limestones, and are therefore in a favourable position to contain water. Tilted in the west by the great uplift which raised the Rockies, these older sandstones outcrop along the mountain slopes, and are covered with a thick mantle of younger deposits in the central plains, so that the water contained in them is here subject to great pressure, and a good artesian flow may be obtained. The Dakota (Cretaceous) sandstone, for instance, which is the most important of the water-bearing formations, has its intake zone at an altitude of from 4000 to 6000 feet, while the region of outflow is only 1000 feet above sea-level. The surface pressure of its waters in South Dakota is over 175 lbs. to the square inch.

The basal sandstone of Cambrian age certainly contains water, which has been reached by deep wells in the lower Missouri valley, but in the central region it lies too deep for investigation. The Ordovician rocks are chiefly limestone, and therefore not likely to contain water, and, dipping steeply, they are soon carried beyond reach from the surface, and the same is true of the Carboniferous formations. The Jurassic sandstone of Wyoming contains water of some importance, which is tapped by several wells, but the Dakota water-horizon is the most widely spread and most useful in the region of the Great Plains. The thickness of this stratum varies from 150 to 300 feet, resting on Red beds and Carboniferous limestones and shales, and overlain by a great mass of clays and shales. Its outcrop

is along the uplifts of the Black hills, Bighorns and Rocky mountain Front ranges, and in the Arkansas valley in South Colorado, where it receives great volumes of water both from the rainfall and the insinking from the streams. In parts of Dakota the supply has been largely utilized (chiefly for irrigation) by means of artesian wells of a varying depth from 500 to 1000 feet, but in the centre and west of the state there are wide areas still untapped, and the pressure is so great that flows can be obtained in all but the very highest land or in the south-east corner, where the head is lost by the sandstone reaching the surface. In North and Central Nebraska, and Wyoming, on the other hand, the mantle of Tertiary deposits is so thick that the Dakota water-horizon is too deeply buried to have any economic value. In Nebraska, indeed, the underground geology is not well known. But in Kansas, again, this water-supply is not far below the surface, and has been utilized to some extent; while in East Colorado an uplift east of the Rocky mountains brings it within easy reach of the well-driller in the Arkansas valley, where there is an excellent flow.

Mr. Darton's report furnishes the fullest details both of the general geology and of the number and condition of all the existing wells in the region surveyed, and is finely illustrated with photographs and sections. It is accompanied by two maps on the scale of 20 miles to an inch, one showing the geology and the other the distribution of the underground water, the depth of the Dakota sandstone below the surface, the regions of artesian flows, and other details. Both maps are contoured.

POLAR REGIONS.

History of Spitsbergen.

'No Man's Land: A History of Spitsbergen from its Discovery in 1596 to the Beginning of the Scientific Exploration of the Country.' By Sir Martin Conway. Cambridge: University Press. 1906.

This is a work of solid value, embodying a large amount of research among printed and unpublished documents, and much of the information presented would not be met with in literature that is readily accessible. During his study of the early history of Spitsbergen, undertaken originally in connection with his own explorations, but since continued from the intrinsic interest of the subject, Sir Martin Conway has been able to throw new light on many obscure points, but as he has already discussed the chief of these in the *Journal* at various times, it is unnecessary to speak of them at length here. The value of the book to students consists in the large body of information brought together within convenient compass, and the connected story of some of the most romantic episodes in the history of geographical discovery, which it supplies. Apart from the work of pioneers like Barentsz and Hudson, it deals fully with the early whaling enterprise of English, Dutch, and other nations, and the strenuous rivalry to which it led—a subject which can vie for interest with many narratives of fiction.

Among the many questions connected with the gradual increase of geographical knowledge of the group, the author's verdict on the controversial subject of the discovery of the islands in the extreme east, known to the Swedes as Kong Karls Land, deserves special mention. Sir Martin Conway allows, with Prof. Nathorst, that the supposition of the discovery of this group from the south in 1617, under Edge's auspices, is untenable, but he does not therefore abandon the claim that the Wiche's Land of Purchas really represents Kong Karls Land. The English work of that year was evidently devoted chiefly to the route up Wijbe Jans water, near the head of which the high latitude spoken of (or something near it) must really have been attained. There seems no question that North-East Land was

sighted (and named after Sir Thomas Smith) from some point of vantage in this direction, and, as Sir Martin Conway points out, the nearest island of the Kong Karl Land group could almost equally well have been seen on a clear day. The theory that Edge island had been discovered by Joris Carolus in 1614 may not be so readily accepted, but this question is discussed elsewhere in the present number of the *Journal*.

A particularly valuable feature is the extensive bibliography—quite the most complete that has yet been brought together. The confused nomenclature of the Spitsbergen coasts has received careful consideration, and the identification of the old names with actual features is thoroughly satisfactory. It may be noted that Sir Martin Conway rejects, and apparently with justice, the idea that the Sir Thomas Smith's inlet of Fotherby and the English was Hinlopen strait, it being really identical with Wijde bay. The reproductions of early maps, many of which have already appeared in the *Journal*, are a great help in tracing the history of Spitsbergen cartography, while the copy of the Admiralty chart (with modifications as regards nomenclature) supplies a much-needed guide to the modern knowledge of the group, the representations of which, in generally accessible maps, are as a rule most inadequate. Many of the quaint cuts in the earlier narratives are also reproduced.

HISTORICAL GEOGRAPHY.

Early English Travel in the East.

'The Journal of John Jourdain, 1608-1617.' Edited by William Foster, B.A. Cambridge: Printed for the Hakluyt Society.

It is meet and right that the Society bearing the honoured name of Hakluyt should bring the Journal of John Jourdain, "smothered and buried in dark silence," to light and preserve his memorable exploits "from the greedy and devouring jaws of oblivion." In the spring of 1608, the year that the English made their first permanent settlement in America, John Jourdain, a merchant of the then port of Lyme Regis, in Dorsetshire, sailed for the East in the *Ascension*, one of the two ships that were sent by the East India Company in quest of trade in the East. The expedition is known as the company's fourth voyage. After nine years' wandering, and having had his full share of the hardships and hazards incident to the life of a traveller, he returned to England. He kept a careful journal, and from it we receive impressions, not only of lands then unknown, but also of the perils which beset his path, and of the courage and dignity of his character. The original diary has not come to light. The manuscript used for the purpose of this volume is a contemporary copy.

On July 14, 1608, the company's two ships, *Union* and *Ascension*, came to an anchor in Table bay. Here the ships stayed two months to make "the pinnance bigger (for which they had brought out the materials) and higher than in her first bulke for the better passenge the Cape and more servisable for busynes." Time hung heavy on their hands, for Jourdain writes, "Haveing little buysines, for recreation my selfe with other of the marchannts would take our walke to the topp of the hill called the Table, which before wee retourned found it to bee a weerysome journey." He considered the Cape "to be very healthful and commodious for all that trade the East Indyes," and foresaw that the soil was sufficiently rich to invite colonization. "As alsoe if it were manured, I am of opinion that it would beare any thinge that should bee sowen or planted on it, as for all kinde of graine, wheate, barlye, etc., besides all kinde of fruite, as orenges, lemons, limes, and grapes."

After the ships had remained for more than five months in Table bay, the pinnance was completed and launched, receiving the name of the *Good Hope*. On

the evening of September 19, the fleet sailed from Saldania road, and the next night "there blewe soe much winde with an over growne sea," that the *Ascension* "lost companie of the *Union* and pinnance." The *Union* they never saw again. The *Ascension* proceeded up the East Coast, touched at the Comoro islands and Pemba, and after "finding the winde variable as before" and tacking "too and again divers times," on January 19, "aboute nine in the morninge we descryed high land. At three in the afternoone wee sawe other ilands, which wee made to bee four ilands." They were the Seychelles, and now for the first time we have published the interesting account of them given by Jourdain in his journal. He sums up his impressions as follows: "It is a very good and refreshing place for wood, water, coker-nutts, fish, and fowle, without any feare or danger, except the allagartes, for you cannot discerne that ever any people had bene there before us."

On February 1 the *Ascension* again set sail, and on the night of April 7, "about ten wee anchored in 18 fathome water within two leagues of Aden Castell." The *Ascension* was the first British ship, as Mr. Foster informs us, "to visit a place that was destined to become an important outpost of the British Indian Empire." Owing to sundry disputes having arisen between Alexander Sharpey, the commander, and the governor, a Greek renegade, the *Ascension* proceeded to Mocha, and Jourdain, accompanied by two companions and two European renegades who acted as interpreters, set forth out of Aden towards Sana. The journey is mainly interesting on account of it being the first ever made by Englishmen in the interior of Yemen. The route from Mocha to Sana is now comparatively familiar ground. The editor makes no mention of Cruttenden's 'Narrative of a Journey from Mokhá to Sana,' made in 1836. It is interesting to compare Jourdain's account of Sana with Cruttenden's narrative, written two centuries later. Jourdain writes, "It is a very firtill cittie for all provision of victuall and fruite, and reasonable cheape. A wholesome and pleasant place to dwell in, and a temperate aire, neither too hott nor too cold; but upon the waye in the mornings it is as cold as in England." Cruttenden states: "The climate of San'á is too dry to be healthy; there is rarely any dew at night, and the wind produces a feverish feeling in the hands and feet. . . . The thermometer during our stay reached 75° at the highest, and 55° at its lowest point between July 26 and August 20."

From Sana Jourdain and his companions travelled to Mocha, and set sail for India on July 26. A month later, when they were sailing across the Gulf of Cambay for Surat, the *Ascension* struck on a sandbank and was lost. The next night "we were all embarked in the two boats, vizt. in the longe boate 62 persons, besides store of luggage, and in the skiffe 13 persons," and they, fortunately making the mouth of the Ambika river, landed at Gandeve, 28 miles south-east of Surat. "The Governor welcomed us in the best manner, entreatinge us to rest our selves while they made ready such victualls as was to bee had, which was rice with butter and fruite, for the Governor is an Abramane [Brahman], whoe doth never eate of any live thinke, and therefore he prayed us to pardon him, that it was against his lawe."

There is nothing more striking in the early travels of Englishmen in India than the marvellous kindness with which they were treated by the natives. From Surat Jourdain proceeded to Agra, where the Mogul court was at the time, and had an interview with the Emperor Jehangir. "Wee gave the Kinge a peece of gould of our Kinges quoyne, which he looked earnestlie upon and putt it in his pockett." On July 28, 1611, Jourdain and Sharpeigh left Agra and returned by way of Ahmedabad to the coast. In the middle of October, Jourdain, disguised as a native and accompanied by a native broker, slipped through the Portuguese guards, made his way to the beach, and was taken on board the *Peppercorn*. The

latter part of Jourdain's voyages and adventures lay among the East India islands. But the sand has run out. It appears to us that the plan of Mr. Foster's work and the manner in which he has carried it out entitle him to praise of an exceptional kind. The introduction gives a clear summary of the events recorded in the journal. The notes are the results of time and attention bestowed on the different subjects, treated by one who has an absorbing interest in the subjects themselves. Hence their value. They are not manufactured for the occasion, but come from a full mind.

G. W. Forrest.

THE MONTHLY RECORD.

EUROPE.

Some Alpine Tarns.—For several years past Prof. Garwood has devoted a part of each summer to the detailed examination of a group of Alpine tarns, occurring in the Canton Ticino, with a view to elucidating their special character and mode of origin. A particular interest attaches to these tarns, inasmuch as they include, besides some corrie-lakes and others due to the damming of valleys by loose materials, a group of lakes recognized by Prof. Bonney as undoubtedly occupying true rock-basins, and possibly due to excavation by ice. A careful study of them was thus of great importance in connection with the vexed question of the amount of erosive work capable of being effected by ice. A point which also called for investigation was the fact that, besides these lakes in the Airolo district, others further west, such as the Engstlensee and the Trubsee, likewise lay along the outcrop of certain Mesozoic limestones. The work of sounding the lakes was rendered difficult by the altitude at which they lie, and the absence of boats from most of them; but this was got over by the construction of a sounding-machine capable of being used from the banks, while, as it was self-registering both in regard to the position and depth of the soundings, the results were likely to be far more accurate than those obtained in the ordinary way with boats. Prof. Garwood gives a detailed description of the lakes, and the conclusions to be drawn from his examination of them, in the *Quarterly Journal* of the Geological Society (vol. **62**, part 2, May 23, 1906), his paper being accompanied by topographical and contoured maps, and by excellent reproductions of photographs. The most important of the lakes are those of the Val Piora, the largest of which is Lago Ritom, but those examined include several groups near the Val Levantina; the St. Gotthard lakes; and the Lago d'Elio, just within the Italian frontier. Prof. Garwood divides the whole into four groups, under two main headings, viz. (1) those entirely or partly dammed by loose material, and (2) true rock-basins. Some of the first category may be in part rock-bound, but the main interest centres in those of the second category, where this character is definitely established. The chief lakes of the Val Piora, which fall under this heading, are shown to lie along the junction of soluble Calcareous rocks with gneiss or schists, and the axes of greatest depth coincide very closely with these lines of junction. There is nothing to indicate that ice took any real part in the formation of the lakes, but everything points to solution having been the operative agency. There are, however, four rock-basins, forming group 2 of this category, which are more difficult to explain. Like the rest, they lie along the junction of two different rock-types, and, though probably due to differential weathering, their occurrence in their present position seems to have been determined by structural lines of weakness. But even if ice played its part, its action was apparently not

of the nature of digging, but of the removal of less resistant, possibly more weathered, material. The general conclusion is that the lakes of the Canton Ticino so far examined, with the possible exception of the rock-pools of the St. Gotthard hospice, do *not* seem to be due to ice-erosion in the generally understood sense.

The Snowfall of March 23, 1906, in Central Europe.—Like the winters for some ten years past, that of 1905–1906 was marked by the smallness of the snowfall in the whole of Central Europe, and the great fall which occurred on the threshold of the present spring was on this account the more remarkable. From statements by Dr. R. Hennig (of the *Naturwissens. Wochenschrift*) and Dr. A. Swarovsky (Vienna), the following particulars respecting it may be cited. The magnitude of the bad weather consisted less in its intensity than in the abnormal area (for the season of the year) over which it extended, and this feature constitutes an essential part of its specifically geographical character. From East Germany, North-West Hungary, and the Adriatic on one side, and from Denmark and Great Britain on another, the snowfall reached as far as the south of France and Spain. The intensity was also unusual in many places. Even from Spain came reports of a fall of over 3 feet in depth, as also reports to the same effect, but more trustworthy, from the Rhine country, Thuringia, and South Germany. In Thuringia the snowfall was accompanied by storms; and in the Rhine territory, more particularly the Eifel, there was in addition a temperature as low as 12·2° Fahr. In the South-Eastern Alps, moreover, according to the records of the Hydrographical Central Bureau in Vienna, it snowed uninterruptedly on the 22nd and 23rd, the snowfall being here and there attended by violent storms. Here, too, the new snow accumulations, especially in South Tyrol, Carinthia, and Krain, reached depths of from 2½ to 3¼ feet; while in Klagenfurt and at several other places a fine sand, shading from yellow-brown to blood-red, was mingled with the snow layers. Occasion for this abnormal meteorological occurrence was afforded by the peculiar character of the situation, and the shifting of the atmospheric pressure. While an extended maximum rested over North-West Europe from the 20th onward, a sharply pronounced minimum of atmospheric pressure proceeded from the Gulf of Genoa over the plain of Lombardy (where it occurred early on March 23) northwards across the Alps, where, on the morning of the 24th, it rested with its centre somewhat above Berlin. This line of advance, the well-known "Zugstrasse Vb" of von Bebber, is always associated with severe bad weather—in winter, snow-storms; in summer, cloud bursts and inundations. The normal course of this portentous "Zugstrasse" proceeds from Lombardy or the Adriatic by way of Vienna and the Germano-Russian frontier to the neighbourhood of St. Petersburg. This time its more westerly route involved in bad weather West Germany and even Western Europe. Under the analogous weather-phase of March, 1894, which however followed a normal course, Posen, Silesia, Moravia, and Lower Austria suffered especially, and lay buried for days under snow-masses. The huge snowfall in Vienna on May 15 and 16, 1885, must also be referred to the "Zugstrasse Vb." Vienna and the adjoining territories, all lay on the eastern edge, or quite outside, of the storm during the great snowfall of March 23.

The German Coal Trade.—A paper by Dr. Otto Becker in the Annual Report (1905) of the Frankfurt Geographical and Statistical Union gives a concise summary of the history of the German coal trade. Mediæval Germany's wealth of forest is witnessed in Vridank's saying (thirteenth century), "Dem richen walt es lützel schadet, ob sich ein mann mit holze lâdet" ("the rich forest little grudges a man his load of wood"). The first coal-mine worked in Germany was in the neighbourhood of Gachen. There, in the earlier half

of the fourteenth century, pit coal was the fuel most in use. Withal, however, the consumption of coal in Germany throughout the Middle Ages was very limited and confined to districts of surface mining. With the foundation of smelting works in the sixteenth and seventeenth centuries, such grew to be the consumption of wood that the Landgraf of Hesse forbad their further erection. A forest ordinance of the Brunswick Lüneburg lands prohibited the use of charcoal. Of like purport was the mandate of the Duke of Brunswick in 1586. An electoral ordinance of 1654 recommends the coal-pit on the Saar. Till the beginning of the eighteenth century pit-coal consumption was customary only in the industries. Its domestic use was tabooed as prejudicial to health. Inflammation of the lungs and pneumonia in Liège and London were attributed to coal consumption, and smiths dwelling in Zwickau were forbidden the use of coal. House-stoves and hearths were all constructed for wood fires. The coal trade, moreover, long continued shackled by arbitrary restrictions. The Electorate of Saxony, *e.g.*, was forbidden to export coal (1743–1822), while the provinces Cleve, Moers, and Mersk, lay, from 1766 to 1814, under interdict of the import of coal. Any one convicted of implication in such malpractice not only forfeited coals, horses, and waggons, but was liable to imprisonment. In Prussia the Royal Mining Office alone prescribed the working and output of each mine and the selling price of output. Steam, however, proved mightier than the will of princes. Towards the end of the eighteenth century the Saarbrücken Colliery had planted branches in France, Lorraine, and the Palatinate; coals were stored in three places in Westphalia; Saar coal magazines arose on the Mosel, Rhine, Zahn, and Main. Then followed metal rails, deep mining, steam-boilers, and steam-engines, and the requisition of wood for railway sleepers, involving wholesale consumption of coal. As one illustration of the growing magnitude of the coal industry, it is pointed out that, whereas on January 1, 1879, there were in Prussia 38,649 steam-boilers and 35,960 steam-engines (not including army and navy), on January 1, 1901, there were 94,927 steam-boilers and 99,296 steam-engines. Of all the goods carried by rail in the empire, coal constituted, in 1897, 35 per cent., in 1903, 38 per cent. The article includes a tabular view of Germany's different coal districts and their respective outputs from 1881 to 1890, and every year since down to and including 1900; of the export and import of coal and coke from and into Germany and its several regions; and a comparison of the coal-production of Germany with that of all other coal-producing lands.

ASIA.

The Dead Sea Levels.—Observations of the fluctuations of the level of the Dead sea have now been taken for several years by Dr. E. W. G. Masterman, who has recorded the results from time to time in the *Quarterly Statement* of the Palestine Exploration Fund. The last report, which appears in the number for July, 1906, records an unusual rise, following on a rainy season of exceptional intensity. Up to the date of the latest observation (in April last) 37·95 inches of rain had fallen, and the level had risen 34 inches since the date of the autumn observation. The figures given for the years 1901–1905 show that the extent of the rise is not always proportional to the rainfall, for whereas a rainfall of 15·94 inches was followed in 1901 by a rise of 14·5 inches, in the following year a rainfall of 20·04 inches caused a rise of only 6 inches—the smallest within the six years since the observations were commenced. In 1905 a rise of 23 inches had followed on a rainfall of 37·32 inches, so that a wet cycle would seem to have lately set in. A thunderstorm, accompanied by deluges of rain, was experienced on the occasion of the recent visit, having, it is said, been of a severity unknown

before at Jericho in the month of April. Evidences were everywhere visible of the violence of the flood that traversed the wadies.

The Navigable Waterways of India.—An article by R. B. Buckley, C.S.I., in the *Journal of the Society of Arts* (vol. **44**, No. 2780) summarizes the data respecting the navigable waterways of India. Twelve thousand miles of irrigation canals, supplemented by 30,000 miles of distributory channels, yearly water 20,000,000 acres of crops. Of this mileage, constructed during the last sixty years primarily for irrigation, about a quarter has been made navigable. In Madras province navigable canals radiate seawards from the head works at Bezwada, traversing the flat and fully cultivated delta of the Kistna. A like system of canals traverses the Godavery delta. These two systems are connected together by a navigable channel, and both with the Buckingham canal. The Madras coast is thus provided with a continuous canal system over 1000 miles in length, connecting the Godavery and Kistna deltas with the southern districts. Again, in Bengal, Madras, and Lower Burma there are, not counting one or two minor canals in Madras, 1225 miles of navigable canals not used for irrigation. In immediate contact with tidal creeks and rivers communicating with the Bay of Bengal, their brackish waters are unavailable for irrigation. The circular and eastern canal connecting Calcutta and Barrisal, 737 miles long, consists in great part of improved natural tidal channels. The Orissa coast canal consists of a tidal canal, opened for traffic in 1887, which connects the Hugli with the Russelpore river, and of a continuation which connects the Russelpore with the Matai river. Inland water-communication has thus been established between Calcutta and Orissa. The rivers emanating from the Himalayas, and having, therefore, permanent snow-reserves to draw upon in the hot, dry weather, are most available for navigation. Those, on the other hand, dependent on the rainfall of the snowless hills and plains shrink during the dry season, sometimes to exhaustion. All, however, rise greatly during the monsoon. Carrying in the flood season 750,000 cubic feet per second, the Kistna for three months carries only 100 cubic feet. The article includes an account of the shipping capacities and actual navigation of the rivers of India, the burden of traffic borne by them, the respective parts played by rail and river in the carrying trade, the relative importance to India of the utilization of its canals for irrigation or navigation, or both.

Obrucheff's Expedition to the Tarbagatai, Central Asia.—The substance of a letter from the well-known geologist, V. A. Obrucheff, giving some account of the latter's recent expedition to Central Asia (*Journal*, vol. **26**, p. 669), was printed in the second number of *Petermanns Mitteilungen* for the present year, with introductory remarks by Dr. Max Friederichsen. The latter points out the interest of the region examined from the point of view of physical geography, as it forms the border between the later arc of the Altai (according to Suess) and the older arc which has its centre in the Baikal region, and which is marked by disjunctive dislocations having their outcome in troughs and "horsts." Obrucheff's work has shown that the region explored forms the extreme member of this system towards the north-west, since, although folding is seen to a considerable extent, it is rather fracture that has been effective in determining existing morphological features. The traveller, who was accompanied by his two sons, and (at the outset) by two other students, went south from Chuguchak and explored the country towards the Barlyk range and Ebi Nor; afterwards devoting his attention to the eastern section of the Tarbagatai in the direction of Zaizan Nor. The geological formations included marine Devonian and Carboniferous, the latter having the greatest extension. The so-called "Hanhai" strata, a typical Central Asian formation, also occurred, and yielded fossils, the paucity of which has hitherto caused

great uncertainty as to their age. It was found that the Tarbagatai is not directly connected with the Saur range, as has been supposed, but is separated by a deep cleft (probably a rift-valley). There is, therefore, no true mountain knot at this spot. Traces of former glaciation were met with in the Saur, where in former days each of the southern valleys must have been occupied by a glacier 6 to 9 miles long. At present there are only patches of *névé*, or small saddle glaciers, high up on the mountain-sides. Extensive moraines and cirques bear witness to the former extent of the glaciation, which must have been still greater on the northern side. In the Tarbagatai it was probably less. The traveller said that another summer's work would be necessary to complete the examination of the region.

AFRICA.

Exploration of the Sahara.—Mr. Hans Vischer, of the government service of Northern Nigeria, who holds the Society's Diploma in Surveying, left Tripoli on July 9 with the intention of crossing the Sahara, and, if possible, exploring the Tibesti highlands *en route*. The journey is devoid of political significance, and has the approval of the French and Turkish authorities.

The Duke of the Abruzzi's Expedition to Ruwenzori.—Telegrams received in Italy early in July announced that the Duke of the Abruzzi had successfully accomplished the ascent of the highest summit of the Ruwenzori range, and was on his way back to Entebbe. It is not stated what altitude was obtained for the peak ascended, and further details will be awaited with much interest.

The Distribution and Haunts of the Okapi.—According to news received in May * from the Alexander-Gosling expedition, a complete specimen of the okapi had been procured on the Welle river, while interesting information as to its habits had also been obtained. It is generally found singly or in pairs, and frequents the muddy banks of small streams, where grows a large-leafed plant on which it commonly feeds. The animal may be found feeding until 8 a.m., but then retires to the seclusion of the forest. It is very quick of hearing, which makes it difficult of approach. The geographical distribution of the okapi is discussed in a recent number (April, 1906) of the *Proceedings of the Zoological Society* by Dr. Einar Lönnberg, from statements made to him by his compatriot, Lieut. Karl Eriksson, through whom the first skin was obtained by Sir Harry Johnston. He thinks that it occurs practically over the whole of the equatorial forest, from the Ubangi and Welle in the north to a little beyond the Chuapa in the south. Its regular pasture-grounds were thought to be open glades in the forest watered by rivulets with shallow water. Although the flats are sometimes covered by water, the ground is firm, which accounts for the shape of the hoofs. The name okapi (with the accent on the second syllable) is used only by the small tribe of Wambobba, with whom the Wambutti who brought the first specimens happened to have been associated. The name in most of the Congo languages is "dumba."

Herr Frobenius in the Congo Basin.—A third letter from this traveller (*Journal*, **26**, 672; **27**, 629) is printed in No. 6 of the Berlin Society's *Zeitschrift* for the present year. The German ethnologist had extended his researches into the region south-east of Luluaburg, on either side of the Sankuru or Lubilash, which, though partially explored by Wissmann, Le Marinel and others, was still imperfectly known. Its ethnology is of special interest from the fact that the region is a borderland between the South African plateau and the Central African

* According to a later account, the expedition was making its way to Gondokoro, but had reported the melancholy tidings of the death, on June 13, of Captain Gosling, the second member of the party to succumb to the hardships encountered.

forest basin, and that the physical characters seem to have had considerable effect on the movements and distribution of the native tribes. After leaving Luluaburg, the traveller visited the great falls of the Lulua, which he proposes to name the Richthofen falls, since the native designation is constantly changing, being that of the last individual to lose his life at the spot. To the south the country rises very gradually, and beyond 7° S. lat. the river-valleys become less and less marked, the forest also retreating to a distance from the streams. A characteristic of this region are the upland bogs, the existence of which seems to have been a surprise to the traveller, though they would seem to be only the counterpart of the "sponges" of which Livingstone said so much. The native tribes show an astonishing degree of mixture, but Herr Frobenius thinks that some definite facts can be made out as regards their history. He came upon traces of the Mundekete, who, in the Portuguese records of the sixteenth century, are said to have made a victorious progress from the south. The legends of these people state that representatives of the older Baluba stock were then in the land, and the traveller deduces from this that the great dispersion of the Bechuana race (to which stock, he says, the Baluba belong) must have taken place before the sixteenth century. His observations will also throw light on the history of the builders of pile-dwellings in this part of Africa.

Fixed Positions in Nigeria: Captain Ommanney's Expedition.—Captain R. Ommanney, R.E., and Captain G. F. Evans, R.E., have returned to England on completion of the telegraphic longitude work for which they were sent to Northern Nigeria last autumn. Landing at Lagos in the middle of November, 1905, the expedition worked up the telegraph-line *viâ* Jebba to Lokoja, and then along the line which goes through Zungeru and Zaria to Kano. Working eastwards, Leri and Bauchi were fixed, and on the return journey the telegraph-line along the river Benue was used to determine the positions of Ibi, Keffi, and Loko. In all, the longitudes of fifteen important towns in Southern Nigeria were determined with reference to Lagos, the longitude of which had already been fixed by cable from Cape Town. Captain Ommanney is much to be congratulated on the success of his mission, which involved a march of about 2000 miles and much arduous work. The arrangements for the expedition were made jointly between the War Office and the Colonial Office, and the High Commissioner, Sir Frederick Lugard, gave the expedition his constant support and encouragement, without which a successful issue could not have been attained.

Railway Construction in Nigeria.—Official correspondence relative to schemes for improvement of Lagos harbour and the extension of the Lagos railway into Northern Nigeria has been issued as a blue book, with five plans. The contents include an account of six months' soundings and work afloat in the Lagos lagoon, which extends from Porto Novo eastwards for 250 miles; a general report on a scheme of railways for Lagos and Nigeria; researches by Sir Frederic Lugard in the country north of the lower section of the Benue, viz. from Loko to its junction with the Niger, and also that between Lokoja and the mouth of the Kaduna; a reconnaissance from Ibadan to Illorin and Jebba; divergent views on two alternative routes, west and east, for the proposed railway from Ibadan to Illorin; a general concurrence of opinion on Oshogbo as the objective of the first extension from Ibadan, and on Kano as the objective of the Lagos line; a description of the country north and east of Old Calabar and up the valley of the Cross river, tending to the determination of Old Calabar as the terminus of the railway on the east side of the Niger; a survey of the country on the line Egbom—Jebba—Illorin; and a survey carried out in 1903–4 for a railway from Niger to Kano, the total length of the ground covered measuring 1204 miles.

So much research and discussion on the part of experts and men of authority cannot but contribute materially to the elucidation of this region of West Africa. The following is the population of Nigerian towns as given in Mr. Grey's itinerary of his march from Jebba to Kano: Gwari, 5000, reduced by warfare from 20,000; Karechi, 6000; Zaria, 50,000 to 60,000; Lokoro, 4000; Kotokori, 5000; Anchow, 5000; Farki, 8000 to 10,000; Bebeshi, 25,000; Kano, between 100,000 and 200,000. These figures exclude all minor villages and all towns and villages not upon the route, and amount to about 2000 per mile from Gwari to Kano (140 miles).

African Telegraph Lines.—An article in the *Zeitschrift für Kolonialpolitik*, etc. (Heft 12, Jahrg. vii.), takes stock of telegraphic communication in and with Africa. The principal network in South Africa comprises a length of 22,000 miles, five-sixths the total mileage in Italy, one-fourth that in Germany. The Algeria-Tunis lines, stretching from the Moroccan frontier to near Tripoli, and sending out runners south as far as the Sahara, measure 9400 miles. In West Africa, again, 7000 miles of telegraph line, mainly French, having Timbuktu for its northernmost point, serve the various possessions from the Senegal to Dahomey. Of about the same length as the West African is the Egyptian network, which, including branch lines to Eritrea and Abyssinia, now reaches south to Fashoda, Harrar, and Adis-Abeba. Besides these four larger systems, the lines of the French Congo and Congo State, more than 1500 miles long, include a coast-line from Libreville to Masabi and an inland line to Brazzaville. Thence a river-cable across Stanley Pool now links French Congo with the Congo State and the line from Boma to Coquilhatville. German East Africa has a coast line from Tanga to Mikindani, a central line from Dar-es-Salaam to Muanza (completed 1904), and a line from Tanga to Wugiri—more than 1200 miles in all, with Kilimanjaro for objective. In British East Africa a line runs from Mombasa to Lamu; another to Entebbe. Other African lines include those running east and west of Tripoli; in Portuguese East and West Africa; in German South-West Africa and Kamerun; and from Lagos to Saki, Tebba, and Loko. To connect the great telegraph networks there are projected, and already so far advanced as to ensure realization, a trans-Saharan line, a line from Cape Town to Cairo, a line from the Congo mouth to Dar-es-Salaam. The article sets forth the actual situation and outlook of these three projects, and shows how the different African lines communicate with those of the world at large.

AMERICA.

New Expedition to Mount McKinley.—We learn from the *Zeitschrift* of the Berlin Geographical Society that Dr. F. A. Cook has once more started for the region of Mount McKinley, the highest summit of North America, which he hopes to explore under the auspices of the Philadelphia Geographical Society. He is accompanied by Prof. Herschel-Parker, of Columbia University.

Dr. Hauthal on Former Glaciation in the Andes.—Dr. Rudolf Hauthal, whose contributions to South American geography are well known, and who, after fifteen years in Argentina, has been appointed curator of the Hildesheim Museum, has, before leaving South America, carried out some interesting researches into the glaciation of the Andes of Bolivia and Peru (*Petermanns Mitteilungen*, 1906, No. 6). He states that he has ascertained that the same climatic differences which are now observable in different parts of the region in question prevailed also during the Ice Age. Where rainfall is now scanty, he found that glaciation during the Ice Age was also less extensive. He holds, like Dr. Hans Meyer (*Journal*, vol. 25, p. 333), that increase of glaciation was due to extra-terrestrial cosmical causes. The character of the glaciation in different latitudes

bears this out, for while in Patagonia the ice took the form of a vast ice-cap, in Bolivia great glaciers descended from certain centres, filling up the valleys leading down to the plains. He claims to have ascertained also that the main summits of the Bolivian cordillera (Illampu, Illimani, etc.) are laccoliths of granitic character.

POLAR REGIONS.

The Danish Expedition to East Greenland sailed from Copenhagen under the leadership of Mr. Nylius Ericksen on June 24, intending to proceed direct to its destination after touching at the Færoes to take on board dogs and horses. It is proposed, besides filling up the gap in our knowledge of East Greenland between Cape Bismarck and Independence bay, to make a push for the pole early in 1907, and in the following year to attempt the crossing of Greenland from east to west over the inland ice.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Magnetic Survey of the Pacific.—The *Galilee*, the vessel engaged in the magnetic survey of the Pacific ocean under the direction of the Carnegie Institution, started from San Diego, California, for her second cruise, which was to occupy the remainder of the year, on March 2 last. Some of the former staff having been obliged to return to their official duties, the command has now been entrusted to Mr. W. J. Peters, who was second in command of the second Ziegler expedition to Franz Josef Land. The route sketched out leads by Fanning and the Samoa group to Fiji, and thence to Yokohama and the Aleutian islands. Fanning island was reached on March 31.

Monthly Charts of Thermal Anomalies.—The subject of the curves of equal thermal anomaly, *i.e.* of equal deviation of the temperature of any locality from the mean temperature of the latitude in which it lies, has lately been taken up by Dr. Hopfner, who supplies monthly charts of the course of such lines in the second number of *Petermanns Mitteilungen* for the present year. Similar charts (to which, however, Dr. Hopfner does not appear to refer) were worked out by Dr. Spitaler some years ago, both for the year, and for the months of January and July, and were given in the same periodical in 1887 and 1889. Besides tracing the curves for the other ten months, Dr. Hopfner's charts show certain differences in points of detail, as is not surprising considering the sources of error which must unavoidably enter into such an investigation, but the general results of course agree. As is natural, the continents as a rule show an excess of temperature in summer and a defect in winter, while the reverse is the case with the oceans. This does not, however, hold universally, for, as Dr. Hopfner points out, certain regions show either an excess or defect throughout the year. Thus the continent of Europe is always warmer than the mean for its latitude. The chart for the year brings out clearly the relation between ocean currents and anomalies of temperature, regions of excess of temperature being naturally associated with warm currents, the reverse also holding good. The influence of the distribution of land and water is likewise seen in the differences between the north and south, and the east and west, hemispheres. Thus in the south it is the continents that are, broadly speaking, too warm, the oceans too cold, on the year's average, while in the north a reverse tendency is observable.

GENERAL.

Professor Davis on the Scope of Geography.—Prof. Davis returns to this question, an answer to which he has been in search of for some time, in the

Journal of Geography for April of this year. Not content with arriving at a conclusion by the deductive method, he has taken up the question on inductive lines by examining a large number of statements to be found in the best geographical text-books, with a view to finding out what general, unifying principle runs through them. The result will, of course, be to show, not what is the inherent characteristic of geography, but in what light it is generally understood by its votaries, who may themselves show divergent tendencies, or whose statements may require to be judged (as Prof. Davis does not hesitate to do in certain cases) by an external standard. The induction is therefore not entirely rigorous, but all the same the result is of interest. Stripped of accessories which, though naturally associated with the subject, are not of its essence, the statements analyzed are marked as a whole by containing at least two kinds of elements, one of which stands in a more or less distinctly causal relation to the other, and Prof. Davis finds in this idea of causal or explanatory relationship "the most definite, if not the only, unifying principle;" and this, he thinks, should be recognized and acted upon. However important this principle may be in regard to the educational value of the subject, it is difficult to accept it as the main criterion in deciding what geography is, seeing that it must to some extent be shared with other sciences. Prof. Davis allows that of the two elements one is usually of the nature of inorganic control, and the other of organic response, but even with this limitation the field will seem to many unjustifiably wide. The idea of location or distribution, to which Prof. Davis concedes a position of secondary importance only, is surely indispensable for the determination of what relationships are in fact geographical. Thus, the relation between the chemical constituents of a soil and the crops grown on it is hardly geographical, unless it is shown that such constituents may vary with location or some influence directly or indirectly the result of location. Or, again, the relation between temperature and the ebullition of water would not concern geography, were it not that it also varies with change of location. On the other hand, it may be doubted whether Prof. Davis is justified in his dictum that of the elements in the chain of causation one at least must be organic and one inorganic; for although the study may gain its greatest value when this is the case, it will hardly be conceded that an inquiry into the distribution, say, of glaciers, in their relation to climate, is not geographical. At all events, the discussion bears rather on what may conveniently and with most profit be studied as geography, than on the inherent essence of the subject.

Demographical Research in Uncivilized Countries.—A schedule has been drawn up by the International Statistical Institute, which is intended to serve as a guide to those who may be in a position to undertake demographical research in uncivilized countries. The principal points on which information is desired are grouped under thirty-five sections, while useful hints are given whereby the inquiry may be carried out to the best advantage. It is suggested that, where possible, enumerations of the population of suitably selected areas may be made, and forms are drawn up for the record of the data on the basis either of the household or the individual. When such inquiries are carried out by individuals, it is asked that the returns may be sent to the office of the Institute at Rome.

The Wall-maps at the Vatican.—In the May number of the *Rivista Geografica Italiana*, Prof. F. Porena makes what he calls a "confession" in regard to some of the well-known maps painted on the walls of the "Logge di Raffaelo" at the Vatican. The restoration of the decorations of these galleries was entrusted by Pope Pius IX. to Allesandro Mantovani, who, in 1875, took in hand the maps in question, which occupied a portion of the Central "Loggia." They were then in a deplorable state, having been virtually destroyed up to a man's height, while

the inscriptions describing their contents were quite illegible. The only means of restoration which suggested itself was having recourse to the atlas since generally known to geographers as Lafreri's (cf. *Journal*, vol. 26, p. 130). To Prof. Porena was entrusted the task of supplying the missing portions, and in the absence of any indication of the original titles, these also were taken from the same atlas. It was only some years later that Signor Porena discovered, in a work of Padre Taja published in 1750, a reproduction of all the original inscriptions, but on making this known to Mantovani it was thonght better to leave things as they were. His associates in the work having since died, Prof. Porena has thought it best to explain the circumstances of the case, and has thus removed the possibility of mistakes and confusion, which might otherwise have been caused in future by the fictitious titles.

Gold Production in Ancient and Modern Times.—A paper by M. M. Zimmermann in the *Bulletin* of the Lyons Geographical Society, vol. 20, 2nd and 3rd parts, examines with all available lights, uncertain and wavering as in many cases these are, the sites of ancient and mediæval gold production. The sites outside the limits of the ancient world are, in most cases, only to be conjectured from the testimonies of authors read in the light of modern discoveries. The data available have to do chiefly with three regions: Caucasia and Armenia, Central and North Asia, and the mountains of upper Indus. The antiquity of the exploitation of the gold regions which found an outlet at the mouth of the Phasis seems attested by the legend of the golden fleece. Its long continuance as a gold-producing region seems witnessed by Strabo's report that in Swanetia the torrents sweep along with them gold, gathered by the natives by means of hurdles or fleeces, whence the fable of the Golden Fleece may have arisen. Researches in the years 1850–52 led to the discovery, in the beds of some affluents of the Kura, of ancient works for exploiting the once auriferous banks. Funerary remains in Ossetia are notable for the predominance of golden ornaments dating from the sixth to the eighth century A.D. As regards the country of the Agrippéans, Issedons, and Arimaspes, who snatched the gold from the griffons, conjecture is divided between the Siberian steppes, the foreland of the Altai mountains, where Humboldt locates them, and the western basin of the Tarim, to which Richthofen relegates the Issedons. In fact, a wide domain of Siberia and Central Asia bears traces of the hunt for gold. The entire region of the Russian Altai and the Yenisei mountains is strewn with mining works. The paper next enters into a searching elucidation of the Derdæ of Strabo and the Daradræ of Ptolemy, who rescued the gold from giant ants; the country of Ophir, Ethiopia; the gold exploited directly by the Mediterranean peoples; the Roman exploitations registered, *e.g.*, in Ariège (Aurigera); the workings in Upper Egypt, whence is derived the oldest known map of auriferous regions, drawn over sixteen centuries B.C. by an Egyptian cartographer; and lastly the workings in Iberia. It is shown how, in the Middle Ages, more particularly from the tenth to the sixteenth centuries, gold-mining works were carried on and currents of exchange of wide range maintained, such as bear comparison with those of antiquity, and how, down to the gold discoveries in the New World, the Sudan was probably the chief source of supply to Europe.

OBITUARY.

Colonel M. S. Bell, V.C., C.B.

Colonel Mark Sever Bell, v.c., c.b., whose death occurred on June 26 last, was born in Sydney, New South Wales, in 1843, and received a commission in the Royal Engineers in 1862. Soon after he left for India, where he did distinguished service, both as soldier and explorer. He was in command of a company during the Bhutan expedition (1865–66), and was present at the Monar Bridge affair, receiving the medal and clasp. Two years later he took part in the Hazara campaign, and with his company made a remarkable march of 600 miles. During the Ashanti expedition of 1873–74 he acted as special service officer, and shared in the battles of Amoaful and Ordasu. He was also present at the capture of Kumasi. It was at Ordasu that he was awarded the V.C. His first notable piece of exploration was a visit to the Karun river and Kum (described in *Blackwood's Magazine*, April, 1889). During the Burma campaign of 1886–87 he was employed on the Intelligence Staff, and did some useful survey work. His next exploit was to traverse Central Asia from Peking to Kashgar, a distance of 3500 miles. In company with Lieut. (now Sir F. E.) Younghusband, he started from the Chinese capital, but soon afterwards diverged, his companion being the first Englishman to cover the Alashan route to Barkul and Kashgar, and thence by way of the Mustagh pass to Kashmir and India; while Colonel Bell was the first to traverse what he called "the Great Central Asian trade-route" by way of Si-ngan-fu and the provinces of Shensi and Kansu to Hami, Karashahr, and Kashgar. In 1887 Colonel Bell was gazetted aide-de-camp to Queen Victoria, and in 1893 his services were further recognized by the award of the C.B. He was also the recipient of the MacGregor Gold Medal, presented by the Indian United Service Institution, and on one occasion was complimented for his geographical exploits by Lord Curzon in the following quaint words: "His extraordinary travels over almost the whole Asian continent, though little known to the public, entitle him to be considered the territorial Ulysses of this age."

That this eulogy was not undeserved will be apparent from an inspection of the Society's Library catalogue, where, under Colonel Bell's name, will be found nearly a dozen works of his dealing with China, Afghanistan, Persia, Central Asia, Turkey, and Asia Minor, mainly from the point of view of the military strategist. Curiously enough, not one of these appears in the British Museum catalogue.

Captain George Bennett Gosling.

We deeply regret to record the death of Captain G. B. Gosling, of the Rifle Brigade, Lieut. Boyd Alexander's companion and valued coadjutor on the expedition from Nigeria to the upper Nile, to which reference has so frequently been made in the *Journal*. Besides bearing a substantial share in the expenses of the expedition, Captain Gosling had throughout been one of its most active members, and had taken an important part in the survey work which formed one of its main objects, and which devolved almost entirely on him after the death of Captain Claude Alexander and the return of Mr. Talbot. The interesting information respecting the okapi to which reference has been made above (p. 181) was, we believe, largely obtained by him. Captain Gosling was the fourth son of the late Robert Gosling of Hassobury, Essex, and was born on August 26, 1872. He

was educated at Eton and Sandhurst, entering the army in February, 1892. He served for some time in India, and took part in the Tirah campaign of 1897. He went out to South Africa in 1901, and was severely wounded. Although not engaged in actual exploring work previous to joining Lieut. Boyd Alexander, he had done a good deal of big game shooting in Kashmir.

Israel Cook Russell.

In Prof. Israel Russell America has lost one of her foremost geographers, to whom, with two or three others, has been especially due the great advance made in the scientific study of the subject in the United States within the past dozen years. He died at Ann Arbor, on May 1 of this year, after but a short illness, at the comparatively early age of fifty-three years. Born December 10, 1852, he was educated at New York University and at the School of Mines, Columbia University, and after accompanying the United States Expedition to New Zealand to observe the Transit of Venus in 1874, became assistant professor of geology at Columbia University in 1875. For some years after 1878 he was connected with the United States Geological Survey, and thus gained the wide knowledge of field-geology which he afterwards applied with so much effect to the study of more purely geographical questions. His special interest in these had its first important outcome in his expeditions to Mount St. Elias in 1890 and 1891, by which the physical features, and especially the glaciers, of the great mountain were for the first time studied in detail by a fully qualified expert. The series of works on the lakes, glaciers, and volcanoes of North America, which appeared from his pen in 1895–97, were further valuable contributions to the physical geography of the continent, while his work in this direction found a fitting culmination in the volume on North America, which appeared only two years ago in the 'Regions of the World' series. Of his more strictly geological works, that on the geological history of Lake Lahontan was undoubtedly the most valuable.

Russell had been professor of geology at the University of Michigan since 1892, and among his more recent services was his expedition to the West Indies to study the effects of the volcanic catastrophes of 1902. His death will be a serious loss to the cause of geography in the United States.

Nathaniel Southgate Shaler.

Another well-known American geologist, Prof. N. S. Shaler, died less than a month before Prof. Russell, on April 10, 1906. Shaler was born on February 20, 1841, and had therefore completed his sixty-fifth year. Educated at the Scientific School at Harvard, he was more or less connected with that university throughout the greater part of his life, becoming professor of palæontology in 1869, and of geology in 1888, and holding the latter office until his death. While known as a successful and inspiring teacher, he did no less important work in the field, having been at the head of the Kentucky geological survey from 1873 to 1880, and having subsequently been associated with the work of the United States Geological Survey. His interests were exceedingly wide, and his writings included many with humanity as well as nature as theme. In 1885 he contributed the volume on Kentucky to the American Commonwealth series, in which the history and development of the state were dealt with, and in 1894 he brought out, with the co-operation of other writers, a large work dealing with the United States as a whole under many different aspects, political, social, and economic. Several of his more recent writings were concerned with social questions.

CORRESPONDENCE.

Joris Carolus and Edge Island.

In an article published in the *Journal* for June, 1901, and reprinted in a revised form in his book 'No Man's Land,' lately issued by the Cambridge University Press, Sir Martin Conway discusses the voyage of Joris Carolus to Spitsbergen in 1614, and comes to the conclusion that, though no specific claim to that effect was ever made by him, the Dutch navigator is to be credited with the original discovery, in that year, of the island since known as Edge island, from its reputed discoverer, Captain Thomas Edge, who reached it two years later.

The chief authority for this idea is the map drawn by Carolus,* on which certain lands are represented to the south-east of Spitsbergen, coupled with the fact that Carolus is known to have been bent on discovery during the 1614 voyage, and that his movements after August 9 have not been recorded. These considerations certainly point to the possibility that Edge island was discovered in 1614; but before definitely transferring the credit from Edge to Carolus, ought we not to consider whether the map in question is incapable of any other explanation?

On this map, two land-masses are drawn, separated by sounds from the western main island of Spitsbergen and from each other. While the more westerly is marked "Onbekende Cust," that to the east bears the name Marfyn (or Morfyn?), a corruption of the Matsyn of earlier maps, itself based on vague information respecting a "Matthew's land" in the Novaya Zemlya region. Now, if Marfyn really represents Edge island, it is placed some 18° too far east (relatively to the main island), while if the "Onbekende Cust" is considered to represent Whale's Head of Edge island (why, in this case, should it be called "onbekende"?), the extension in longitude of that island becomes no less than 30°, instead of the 4° which it has in reality. May it not be that the two lands in question are merely copied from earlier maps of the type represented by Hoeius' map of 1600, and that of Hondius in Pontanus' History of Amsterdam' (1611), in which there is an indication of land (without name) between Matsyn and Spitsbergen, corresponding with Carolus' "Onbekende Cust," except in so far as the latter has received an extension of area?

That cartographers did not scruple to give a fairly detailed representation of lands inserted from hearsay, need not be insisted on,† while even as regards its form, Marfyn seems suggested by the earlier delineations of Matsyn. Again, even granting that Matsyn was generally connected by cartographers with Spitsbergen rather than with Novaya Zemlya, this would seem to supply an additional argument *against* the identification of Marfyn with Edge island, for if such a connection was commonly supposed to exist before the date of Carolus' map, this explorer would merely be following precedent in showing the coasts as he did, and there is no need to suppose personal knowledge on his part. Later identifications of Marfyn or Marsyn with Edge island would naturally be suggested by his own map.

Besides the strange silence of Carolus in regard to his supposed discovery, the fact that he was said to have "advanced his voyage towards the north pole,"

* Reproduced in part in the *Journal*, vol. 17, p. 625, and in 'No Man's Land,' p. 331.

† An instance is the fictitious Y^{e} des Géants in the Southern Indian ocean in Desceliers' map of 1546, which is shown with various rocks and shoals round its coast. If it be said that this really represents Zanzibar, shifted from its true position, equally well might Marfyn represent some real, but misplaced, portion of the Novaya Zemlya coast.

together with his (unjustifiable) claim to have reached 83°, evidently imply that he based his title to reward on work to the north, rather than the south-east, of Spitsbergen.

EDWARD HEAWOOD.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1905-1906.

RESEARCH DEPARTMENT.

May 11, 1906.

"Some Problems on the Physical Geography of the Seistan Basin." By Colonel Sir Henry McMahon, K.C.I.E., C.S.I.

June 8, 1906.

"A Plea for the Investigation of the Biological (Floral and Faunal) and Anthropological (Racial and Cultural) Distributions in the Pacific." By Prof. A. C. Haddon, F.R.S.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C. R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k. u. k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological, etc.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Alps—Dent-Blanche. *C. Rd.* **142** (1906): 527-529. **Argand.**
Sur la tectonique du massif de la Dent-Blanche. Note de Émile Argand.

Alps—Structure. *B.S. Belge Géol.* **19** (1905): 377-440. **Van de Wiele.**
Les théories nouvelles de la formation des Alpes et l'influence tectonique des affaissements méditerranéens. Par le Dr. C. Van de Wiele. *With Map.*

Austria—Herzegovina. *La G., B.S.G. Paris* **13** (1906): 91–102. **Danes.**
La région de la Narenta inférieure. Par Dr. V. Daneš. *With Illustrations.*

Austria—Karst. *G.Z.* **12** (1906): 47–49. **Oestreich.**
Zur Hydrographie des Karsts. Von Karl Oestreich.

Balkan Peninsula. **Fraser.**
Pictures from the Balkans. By John Foster Fraser. London: Cassell & Co., 1906. Size 8 × 5½, pp. xii. and 298. *Map and Illustrations. Price* 6*s. Presented by the Publishers.*

Baltic—Bornholm and Gothland. *M.G. Ges. München* **1** (1905): 482–484. **Günther.**
Bornholm und Gotland. Von Prof. Dr. S. Günther.

Denmark—Tides. *Oversigt K. Dansk. Vidensk. S. Forh.* 1905 (1906): 505–531. **Paulsen.**
Communications du service maréographique de l'Institut météorologique de Danemark. Par Adam Paulsen. *With Map and Illustrations.*

France. *B. Musée Océanograph. Monaco*, No. **67** (1906): pp. 32. **Guérin.**
Notes préliminaires sur les Gisements de Mollusques comestibles des Côtes de France. Le Golfe du Calvados. Par J. Guérin. *With Map and Illustrations.*
Papers on other sections of the coasts have previously appeared.

France—Auvergne. *C. Rd.* **142** (1906): 239–241. **Glangeaud.**
Reconstitution d'un ancien lac oligocène sur le versant nord du massif du Mont-Doré (lac d'Olby). Note de Ph. Glangeaud.

France—Brittany. *C. Rd.* **142** (1906): 468–470. **Cayeux.**
Les tourbes des plages bretonnes, au nord de Morlaix (Finistère). Note de L. Cayeux.
On vegetable remains intercalated among the sands.

France—Dauphiné. *La G., B.S.G. Paris* **13** (1906): 139–141. **Vidal, Offner, and Rabot.**
Les Colonies de plantes méridionales dans le haut Dauphiné. Par Charles Rabot. *With Map.*
Summary of a memoir by MM. Vidal and Offner in the publication of a local scientific society.

France—Hydrology. **Gosselet and Demangeon.**
La G., B.S.G. Paris **13** (1906): 136–139.
L'appauvrissement des sources dans les pays de plaines du nord de la France. Par A. Demangeon.
Analysis of a paper by M. Gosselet in *Ann. Soc. Géol. Nord.*

France—Savoy. *B.S. Neuchatel. G.* **16** (1905): 17–48. **Girardin.**
Les Glaciers de Savoie. Étude physique. Limite des neiges. Retrait. Par Paul Girardin. *With Illustrations.*

France—Water-power. *La G., B.S.G. Paris* **13** (1906): 141–146. **Bresson and Rabot.**
Les forces hydrauliques dans le Calvados, l'Eure et le Maine-et-Loire. Par Charles Rabot. *With Maps.*
From a paper by M. Bresson in the *Annales* of the Ministry of Agriculture.

Germany. *Verh. 15. Deutsch. Geographentages Danzig* (1905): 173–184. **Hahn.**
Bericht der Zentral-Kommission für wissenschaftliche Landeskunde von Deutschland während der Geschäftsjahre 1903 bis 1905. Von Prof. Dr. F. Hahn.

Germany—Agriculture. **Schwabach.**
Agriculture in Germany. Foreign Office, Miscellaneous, No. 645. 1906. Size 9½ × 6½, pp. 22. *Price* 1½*d.*

Germany—Coasts. **Lehmann.**
Verh. 15. Deutsch. Geographentages Danzig (1904): 151–158.
Die Gesetzmässigkeit der Alluvialbildungen an den deutschen Ostee-Küsten. Von Dr. F. W. Paul Lehmann.

Germany—Dunes. *Verh. 15. Deutsch. Geographentages Danzig* (1905): 159–172. **Solger.**
Ueber fossile Dünenformen im norddeutschen Flachlande. Von Dr. F. Solger. *With Maps and Diagram.*

Germany—East Prussia. **Braun.**
Das Frische Haff. Von Dr. Gustav Braun. (Sonderabdruck aus der Zeitschrift für

Gewässerkunde, vii. Band. 3 Heft.) Size 9½ × 6½, pp. [19]. *Sketch-maps and Diagrams. Presented by the Author.*

Germany—Lakes. *Verh.* 15. *Deutsch. Geographentages Danzig* (1905): 201–204. **Seligo.**
Ueber Temperaturbeobachtungen in westpreussischen Seen. Von Dr. Seligo.

Germany—Meteorology. **Hellmann.**
Ergebnisse der Niederschlags-Beobachtungen im Jahre 1902. Von G. Hellmann. (Veröffentlichungen des K. Preuss. Meteorologischen Instituts.) Berlin: A. Asher & Co., 1905. Size 13 × 10, pp. l. and 244. *Map. Presented by the Institute.*

Germany—Thuringia. **Schlüter.**
Die Siedelungen im nordöstlichen Thüringen. Von Dr. Otto Schlüter. Berlin: Hermann Costenoble, 1903. Size 10 × 6½, pp. xx. and 454. *Maps and Plans. Price* 16*s.* 3*d.*

Dr. Schlüter is known as one of the most persevering students of the geography of settlements, and the present work may serve as an excellent instance of the methods of such study, in the case of a particular region.

Germany—Vistula. **Bindemann.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 184–200.
Die Veränderungen der Mündungsarme der Weichsel. Von — Bindemann. *With Maps.*

Germany—West Prussia. **Schubert.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 205–206.
Wald und Niederschlag in West Preussen, Posen und Schlesien. Von Prof. Dr. Schubert.

Germany—West Prussia. *Deutsch. Rundschau G.* **28** (1906): 218–221. **Mankowski.**
Dünenwälder auf der Halbinsel Hela. Von H. Mankowski.

Greece. *G.Z.* **12** (1906): 38–47. **Sapper.**
Inseln des ägäischen Meeres. Eine landschaftliche Skizze. Von Karl Sapper. *With Illustrations.*

Greece—Eleusis. **Philios and Gatliff.**
Elevsis, her Mysteries, Ruins, and Museum. Translated from the French of Demetrios Philios, Director of the Excavations (1882–1894), by Hamilton Gatliff. London: Sidney Appleton, 1906. Size 7½ × 5, pp. viii. and 80. *Plan and Illustrations. Price* 5*s. net. Presented by the Publisher.*

Holland—Waterways. *Ts. K. Ned. Aard. G. Amsterdam* **23** (1906): 316–319. ——
Drentsche Hoofdvaart en N.W.-Kanaal. Door J. B. R.
On the recent low water-level in some of the canals in Holland.

Italy—Anthropology. *Riv. G. Italiana* **12** (1905): 553–559. **Giuffrida-Ruggeri.**
Differenza di statura fra coscritti e reclute nelle diverse regioni d'Italia, a proposito di un tipo mediterraneo di alta statura. Dott V. Giuffrida-Ruggeri.

Italy—Anthropology. ——
Antropometria militare. Risultati ottenuti dallo spoglio dei fogli sanitarii dei militari delle classi 1859–63 eseguito dall' Ispettorato di Sanità militare per ordine del Ministero della Guerra. Incaricato della direzione dei lavori Dr. Ridolfo Livi. 2 Parts, and Atlas to Part i. Roma, 1896–1905. Size 12 × 9, pp. (part i.) 420; (part ii.) viii., 180, and 228. *Diagrams. Presented by the Ispettorato di Sanità militare, Rome.*

Italy—Florence. **Allen and Cruickshank.**
Grant Allen's Historical Guides. Florence. New edition, revised and enlarged by J. W. and A. M. Cruickshank. London: E. Grant Richards, 1906. Size 7 × 4½, pp. 304. *Price* 3*s.* 6*d. net. Presented by the Publisher.*

Italy—Sicily. *Riv. G. Italiana,* **12** (1905): 516–522, 602–615. **Crinò.**
La Carta di Sicilia di Agatino Daidone e notizie di cartografia siciliana, tratte dai manoscritti della Biblioteca comunale di Palermo e della Fardelliana di Trapani. Memoria del Prof. S. Crinò.

Lake of Constance. *M.G. Ges. München* **1** (1905): 488–490. **Kittler.**
Die Entstehungsgeschichte des Bodensees. Von Dr. C. Kittler.

North Sea. ——
North Sea Pilot. Part III. East Coast of England, from Berwick to the North

Foreland, including the Rivers Thames and Medway. Seventh Edition. London: J. D. Potter, 1905. Size 9½ × 6, pp. xx. and 428. *Index-chart. Price 2s. 6d.*

Rhine. **Baedeker.**

The Rhine from Rotterdam to Constance, Handbook for Travellers. By Karl Baedeker. 16th edition. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. xxxiv. and 462. *Maps and Plans. Price 7m. Presented by the Publishers.*

Switzerland—Tunnel. *La G., B.S.G. Paris* **13** (1906): 215–221. **Girardin.**

Le Percement des Alpes bernoises. Par Paul Girardin. *With Profiles.*

On the latest tunnel project.

United Kingdom—Great Britain. **Baedeker.**

Great Britain. Handbook for Travellers. By K. Baedeker. 6th edition, revised and augmented. Leipzig: K. Baedeker; London: Dulau & Co., 1906. Size 6½ × 4½, pp. lxvi. and 606. *Maps and Plans. Price 10m. Presented by the Publishers.*

To the already large number of maps and plans given in previous editions, four of the former and nineteen of the latter are now added.

United Kingdom—Ireland. **Ward.**

Thorough Guide Series. Ireland (Part ii.) East, West, and South, including Dublin and Howth. By C. S. Ward. 5th edition. London: Dulau & Co., 1906. Size 6½ × 4½, pp. xxiv. and 236. *Maps and Plans. Price 5s. net. Presented by the Publishers.*

ASIA.

Asia—Historical. *Indian Antiquary* **35** (1906): 33–47. **Franke and Nicolson.**

The Sok and Kaniska. Passages from an article by Dr. O. Franke, Halensee, entitled "Beiträge aus Chinesischen Quellen zur Kenntnis der Türkvölker und Skythen Zentralasiens," published in the *Proceedings* of the Royal Academy of Sciences of Prussia, 1904, selected and translated by Miss C. Nicolson.

Dr. Franke considers the Sok of the Chinese to be identical with the Sakas (cf. July number, p. 76). He traces their various movements, and also discusses the date of Kanishka's reign.

Baluchistan. **Yate.**

Proceedings of the Central Asian Society, Baluchistan. By Colonel C. E. Yate, C.S.I., etc. London: Central Asian Society, 1906. Size 10 × 6½, pp. 40. *Presented by the Author.*

A valuable account of the present condition and general relations of Baluchistan, of which the author was Chief Commissioner from 1900 to 1904.

Central Asia—Tian Shan. *M.G. Ges. München* **1** (1905): 484–488. **Merzbacher.**

Forschungsreise in den Tian-Schan. Von Dr. Gottfried Merzbacher.

China. **Richard.**

L. Richard. Géographie de l'Empire de Chine (Cours Supérieur). Chang-Hai, Imp. de la Mission Catholique à l'Orphelinat de T'ou-sè-wè, 1905. Size 7½ × 5, pp. xviii., 564, and xxii. *Maps and Plans. Presented by the Publishers.*

Originally intended for use in the French schools in China, but extended so as to form a compendium of Chinese geography for more general purposes. Each of the provinces is described in turn, and there are sections on the coasts, the political and economic geography, and on the dependent territories.

Chinese Empire—Tibet. *M.G. Ges. München* **1** (1905): 496–499. **Filchner.**

Expedition zum Oberlauf des Hwangho in Osttibet. Von Leutnant W. Filchner.

Chinese Empire—Tibet. **Sandberg.**

Tibet and the Tibetans. By Graham Sandberg. London: Society for Promoting Christian Knowledge, 1906. Size 10 × 6½, pp. x. and 334. *Price 5s. Presented by the Publishers.*

Chinese Geography. *T'oung Pao* **6** (1905): 519–571. **Chavannes.**

Les pays d'occident d'après le Wei lio. Par E. Chavannes.

The Wei lio was a historical work, now lost, which is quoted from by a Chinese author who wrote in 429 A.D.

Eastern Asia. *Scottish G. Mag.* **22** (1906): 181–188. **Little.**

Hanoi and Kwang-Chow-Wan; France's last acquisition in China. By Mrs. Archibald Little.

French Indo-China. **Patté.**

Paul Patté. Hinterland Moï. Avec une Introduction de M. le Général F. Canonge et une Lettre-Préface de M. le Lieut.-Colonel Adam de Villiers. Paris: Plon-Nourrit et Cie., 1906. Size 7½ × 5, pp. viii. and 260. *Map and Illustrations. Price* 3*s.* 3*d.*

Account of the author's work as a French official in a little-known part of Indo-China.

India. **Dubois and Beauchamp.**

Hindu Manners, Customs, and Ceremonies, by the Abbé J. A. Dubois. Translated from the Author's later French MS. and edited, with Notes, Corrections, and Biography, by Henry K. Beauchamp. With a Prefatory Note by the Right Hon. F. Max Müller and a Portrait. Third edition. Oxford: Clarendon Press, 1906. Size 7½ × 5, pp. xxxiv. and 742. *Price* 6*s. net. Presented by the Publishers.*

India. **Abbott.**

Through India with the Prince. By G. F. Abbott. London: E. Arnold, 1906. Size 9½ × 6, pp. x. and 312. *Map and Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Embodies a good deal of shrewd observation on questions bearing on the present and future of the Indian Empire. The views expressed are generally judicious, though a slightly cynical vein is now and then apparent.

India—Bengal. *J. East Indian Association* **39** (1906): 65–79. **Mitra.**

The Partition of Bengal and the Bengali Language. By S. M. Mitra.

India—Bengal. ———

Backergunge District Gazetteer. Statistics, 1901–02 (pp. 31); Bogra (pp. 27); Chittagong (pp. 29); Chittagong Hill Tracts (pp. 15); Dacca (pp. 29); Dinajpur (pp. 29); Faridpur (pp. 29); Jalpaiguri (pp. 29); Malda (pp. 29); Mymensingh (pp. 33); Noakhali (pp. 29); Pabna (pp. 29); Rajshahi (pp. 29); Rangpur (pp. 31); Tippera (pp. 29). Calcutta, 1905. Size 8½ × 5½. *Presented by the India Office.*

India—Census. **Hardy.**

Memorandum on the Age Tables and Rates of Mortality of the Indian Census of 1901. By G. F. Hardy. Calcutta, 1905. Size 13½ × 8½, pp. 66.

India—Gujarāt. *J.R. Asiatic S.* (1906): 458–460. **Fleet.**

The name Gujarāt. By J. F. Fleet.

India—Madras. ———

Madras District Gazetteers. Statistical Appendix for South Canara District (pp. iv. and 74); Ditto Kurnool District (pp. iv. and 46); Ditto, Tinnevelly District (pp. iv. and 58). Madras, 1905. Size 10 × 6½. *Presented by the India Office.*

India—Nepal. **Lévi.**

Le Népal. Étude historique d'un Royaume Hindou. Par Sylvain Lévi. Vol. 2. (Annales du Musée Guimet, Bibliothèque d'Études, T. xviii.) Paris: E. Leroux, 1905. Size 10 × 6½, pp. 410. *Illustrations. Price* 10*s.*

This volume, which completes the work (*Journal*, vol. **26**, p. 235), deals with religion and history, concluding with an account of a visit to Nepal in 1898.

India—United Provinces. **Nevill.**

Sitapur: A Gazetteer, being volume **40** of the District Gazetteers of the United Provinces of Agra and Oudh. By H. R. Nevill. Allahabad, 1905. Size 9 × 6, pp. 224, xliv., and vi. *Map. Presented by the India Office.*

Japan. **Kaempfer.**

The History of Japan, together with a Description of the Kingdom of Siam, 1690–92. By Engelbert Kaempfer, M.D. Translated by J. G. Scheuchzer, F.R.S. 3 vols. Glasgow: James MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. **1**) xc. and 338; (vol. **2**) x. and 398; (vol. **3**) x. and 386. *Facsimile Maps and Illustrations. Price* 37*s.* 6*d. net. Presented by the Publishers.*

The attention directed to Japan at the present time lends a special interest to this reprint of one of the most important of the early works on that empire.

Malay Archipelago—Gilolo. **Oudemans and Schut.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 335–340.
De naam "Halemahera," door P. A. Oudemans, met toelichting door J. A. F. Schut.

Malay Archipelago—Java. **Deknatel.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 332–335.
Bestijging van den Tjerimai. Door J. A. Deknatel.

Malay Archipelago—Java. *Deutsch. Rundschau G.* **28** (1906): 241–244. **Zürn.**
Von Tosari zum Bromo. Reiseerinnerungen aus dem Vulkangebiet Javas. Von Ralph Zürn. *With Map and Illustrations.*

Malay Archipelago—Sumatra. **Tobler.**
Ts. K. Ned. Aard. G. Amsterdam **23** (1906): 199–315.
Topographische und Geologische Beschreibung der Petroleumgebiete bei Moeara Enim (Süd-Sumatra). Von Dr. A. Tobler. *With Maps and Illustrations.*

Siam. **Robert.**
Le Siam. Étude de Géographie politique. Par Ernest Robert. (Travaux du Séminaire de Géographie de l'Université de Liége. Fascicule V.) Liége, 1906. Size 10 × 6½, pp. 76. *Map.*

AFRICA.

Abyssinia—Trade.
Berichte über Handel und Industrie, zusammengestellt im Reichsamt des Innern. Band ix. 1 Heft. Die Handels- und Verkehrsverhältnisse Abessiniens. Berlin: Carl Heymann, 1905. Size 9 × 6, pp. 60. *Map. Price* 1*s.*

Africa. **Hotchkiss.**
Sketches from the Dark Continent. By Willis R. Hotchkiss. London: Headley Brothers, [*not dated*]. Size 7½ × 5, pp. 130. *Price* 1*s. net. Presented by the Publishers.*
Treats of missionary work in British East Africa, and the mission question in general.

Algeria. **Belloc.**
Esto Perpetua. Algerian Studies and Impressions. By H. Belloc. London: Duckworth & Co., 1906. Size 7½ × 5½, pp. viii. and 192. *Illustrations. Price* 5*s. net. Presented by the Publishers.*
This little book brings out in a striking way the salient facts, both of the physical geography and history of North Africa.

Algeria. *La G., B.S.G. Paris* **13** (1906): 134–135. **Pelet.**
La position géographique d'El Oued. Par Paul Pelet.

Basutoland. *J. African S.* **5** (1906): 233–251. **Mabille.**
The Basuto of Basutoland. By Rev. A. Mabille.

British East Africa.
Handbook for East Africa, Uganda, and Zanzibar, 1906. Mombasa: Printed at the *East African Standard* Printing Press. Size 7½ × 5, pp. iv. and 262. *Map. Presented by H.M. Commissioner for the East Africa Protectorate.*
A revised edition of this useful handbook.

Cape Colony—Little Namaqualand. **Ronaldson.**
J. Geol. S. South Africa **8** (1905): 158–166.
Notes on the Copper Deposits of Little Namaqualand. By J. H. Ronaldson. *With Map.*

Central Africa. *J. African S.* **5** (1906): 182–186. **Dawe.**
An Ascent of Ruwenzori. By M. J. Dawe.
Mr. Dawe ascended to a point a little above the base of the glacier at the head of the Mubuko valley. The paper consists mainly of botanical notes.

Congo State. *Z. Ges. E. Berlin* (1906): 114–118. **Frobenius.**
Leo Frobenius' Forschungsreise in das Kassai-Gebiet. II. Bericht über die Reisen und Arbeiten vom 30. Mai bis 2. Dezember 1905. Von Leo Frobenius. *With Illustrations.*
Noticed in the June number (p. 629). See also *ante*, p. 181.

Dahome. **François.**
Notre Colonie du Dahomey, sa formation, son développement, son avenir. Par

G. François. Préface de Lucien Hubert. Paris: Émile Larose, 1906. Size 10 × 6½, pp. viii. and 284. *Illustrations. Price* 6 *fr.*

A general sketch of Dahome, with a discussion of the possibilities of its economic development.

Egypt. *M.G. Ges. München* 1 (1905): 494–496. **Stromer.**

Geographische Beobachtungen in der libyschen Wüste. Von Dr. Ernst Freiherr Stromer von Reichenbach.

French Congo. *Rev. Française* 31 (1906): 140–148. **Lasalle.**

Réorganisation du Congo Français. Par C. de Lasalle.

See note in the April number (p. 406).

French West Africa. **Decorse and Gaudefroy-Demombynes.**

Docteur Decorse et M. Gaudefroy-Demombynes. Rabah et les Arabes du Chari. Documents Arabes et Vocabulaire. Paris: E. Guilmoto, [*not dated*]. Size 9 × 6, pp. 64.

Reproduction of documents bearing on the career of Rabah, written by, or taken down from the mouth of, persons closely associated with the conqueror.

Lake Chad. *La G., B.S.G. Paris* 13 (1906): 195–214. **Tilho.**

Exploration du lac Tchad. (Février–mai 1904.) Par Jean Tilho. *With Maps and Illustration.*

Noticed in the present number (p. 168).

Liberia. **Johnston.**

Liberia. By Sir Harry Johnston, G.C.M.G., etc. With an Appendix on the Flora of Liberia. By Dr. Otto Stapf. 2 vols. London: Hutchinson & Co., 1906. Size 10 × 7, pp. xxviii. and 1184. *Maps and Illustrations. Price* 42*s. net. Presented by the Author.* [To be reviewed.]

Madagascar. **Martonne.**

Rev. Madagascar 7 (2) (1905): 527–545; 8 (1) (1906): 27–55, 104–124, 215–240.

Fianarantsoa et le Betsiléo Central. Par Lieut. Ed. de Martonne. *With Maps and Illustrations.*

Mauritius. *P.R.S.*, Ser. A, 76 (1905): 507–511. **Claxton.**

Preliminary Report on a Survey of Magnetic Declination near the Royal Alfred Observatory, Mauritius. By T. F. Claxton.

Morocco. *Renseignements Col., Comité Afrique Française* (1906): 49–63. **Pobeguin.**

Documents de la mission maritime Française du Commandant Dyé. Notes sur Mogador. Par E. Pobeguin. *With Illustrations.*

Niger. *La G., B.S.G. Paris* 13 (1906): 81–90. **Desplagnes.**

Une mission archéologique dans la vallée du Niger. Par — Desplagnes. *With Illustrations.*

Nigeria. *Scottish G. Mag.* 22 (1906): 173–181. **Watt.**

Southern Nigeria. By James Watt. *With Illustrations.*

Nile. **Lyons.**

Finance Ministry. Survey Department, Egypt. The Physiography of the River Nile and its Basin. By Captain H. G. Lyons. Cairo, 1906. Size 11 × 7½, pp. viii. and 412. *Maps and Diagrams.* [To be reviewed.]

Nile Valley. *B.S. Belge Géol.* 19 (1905): 260–263. **Rutot.**

La géologie de la vallée du Nil et les nouvelles découvertes éolithiques et paléolithiques qui y ont été faites. Par A. Rutot.

North Africa. **Neumann.**

Nordafrika (mit Ausschluss des Nilgebietes) nach Herodot. Von Richard Neumann. Leipzig: Gustav Uhl, [*not dated*]. Size 9 × 6, pp. 166. *Price* 2*m. Presented by the Publisher.*

South Africa—Natal. ———

South Africa. Natal Route Book. 2 vols. Prepared for the General Staff, War Office. 1906. Size 7½ × 5, pp. (vol. 1) x. and 364; (vol. 2) x. and 714. *Maps and Illustrations. Presented by the War Office.*

South Africa—Zululand. ———

South Africa. Military Report on Zululand. Prepared for the General Staff, War Office, 1906. Size 6½ × 4½, pp. viii. and 458. *Map and Diagrams. Presented by the War Office.*

Begins with a chapter on the physical geography of Zululand.

NORTH AMERICA.

Canada. **Whates.**

Canada, the New Nation. A book for the Settler, the Emigrant, and the Politician. By H. R. Whates. London: J. M. Dent & Co., 1906. Size 8 × 5¼, pp. xiv. and *Illustrations. Price 3s. 6d. net. Presented by the Publishers.*

Discusses, from personal experience, the prospects offered by Canada to immigrants, especially from the point of view of agriculture. Some other questions are also treated of. The book is written from the standpoint of an unprejudiced observer, and should be of great use to intending immigrants, while also urging a plea for a definite policy as regards emigration in general.

Canada. *Blackwood's Mag.* **179** (1906): 392–402. **Hanbury-Williams.**

At the Mouth of the Saskatchewan. By C. Hanbury-Williams.

Canada. *La G., B.S.G. Paris* **13** (1906): 151–153. **Rudaux.**

Le climat de Dawson-City. Par Lucien Rudaux. *With Diagram.*

Canada. ———

Dominion of Canada. Annual Report of the Department of Indian Affairs for the year ended June 30, 1905. Ottawa, 1906. Size 10 × 6½, pp. xxxvi., 452, and 168. *Illustrations.*

Canada—British Columbia. **Robertson.**

Windy Arm Mineral Locations in the Atlin Mining Division. By W. F. Robertson. (Provincial Bureau of Mines, Bulletin No. 1.) Victoria, B.C., 1905. Size 10½ × 7½. *Map.*

Canada—Historical. **Salone.**

Émile Salone. La colonisation de la Nouvelle-France. Étude sur les origines de la Nation Canadienne Française. Paris: E. Guilmoto, [*not dated*]. Size 9 × 5½, pp. xii. and 468. *Map. Price 7.50 fr.*

A well-written history of the beginnings of Canada under the French.

Canada—Selkirk Range. **Wheeler.**

The Selkirk Range. By A. O. Wheeler. Vol. 1. Ottawa, 1905. Size 9½ × 6½, pp. xvii. and 460. *Illustrations. Presented by the Author.* [To be reviewed.]

Canada—Treaties. *T. Hist. and Sc. S. Manitoba*, No. 66 (1905): pp. 12. **Laird.**

Our Indian Treaties. By Hon. David Laird.

Mexico—Mines. **Southworth.**

Las Minas de México (Edición ilustrada). Historia, Geologia, Antigua Mineria, y Descripción General de los Estados Mineros de la República Mexicana, En Español é Inglés. Tomo ix. Octubre, 1905. Publicado . . . por J. R. Southworth. Size 13 × 10½, pp. 260. *Illustrations. Two Copies, Presented by the Author and S. Hardman, Esq.*

United States. **Audubon**

Audubon's Western Journal: 1849–1850. Being the MS. record of a trip from New York to Texas, and an overland journey through Mexico and Arizona to the goldfields of California. By John W. Audubon. With biographical memoir by his daughter, Maria R. Audubon. Introduction, notes, and index by Frank Heywood Hodder. Cleveland: The Arthur H. Clark Co., 1906. Size 10 × 6½, pp. 250. *Map, Portrait, and Illustrations. Price $3 net.*

Printed from an unpublished MS. The author, son of the great ornithologist, accompanied Colonel Webb on his expedition across the continent in the days of the gold fever.

United States. **Fordham and Ogg.**

Personal Narrative of Travels in Virginia, Maryland, Pennsylvania, Ohio, Indiana, Kentucky; and of a Residence in the Illinois Territory, 1817–1818, by Elias Pym Fordham. Edited by Frederic Austin Ogg. Cleveland: The Arthur H. Clark Co., 1906. Size 9½ × 6½, pp. 248. *Facsimile Sketches and Plans. Price $3 net.*

From a hitherto unpublished manuscript. It throws valuable light on the settlement of the lands beyond the Alleghanies in the early part of the nineteenth century.

United States—Adirondack Mts. *Popular Sci. Monthly* **68** (1906): 195–210. **Kemp.**

The Physiography of the Adirondacks. By Prof. J. F. Kemp. *With Illustrations.*

Noticed in the July number (p. 79).

United States—Altitudes. *B.U.S. Geol. Surv.*, No. 274 (1906): pp. 1072. **Gannett.**

A Dictionary of Altitudes in the United States (Fourth Edition). Compiled by Henry Gannett.

United States—Arizona. **Lindgren.**

The Copper Deposits of the Clifton-Morenci District, Arizona. By W. Lindgren. (U.S. Geological Survey, Professional Paper, No. 43.) Washington, 1905. Size 11½ × 9, pp. 376. *Maps and Illustrations. Presented by the U.S. Geological Survey.*

United States—California.

Preliminary Report of the State Earthquake Investigation Commission. Berkeley, 1906. Size 11 × 7½, pp. 20.

United States—Coal. **Bell.**

Coal Industry of the United States in 1904. Foreign Office, Miscellaneous, No. 643, 1906. Size 10 × 6¼, pp. 62. *Price* 3*d.*

United States—Colorado. **Davis.**

B. Museum Comp. Zoology, Harvard Coll., Geol. Ser. **8** (1905): 1–12.

Glaciation of the Sawatch Range, Colorado. By W. M. Davis. *With Plate.*

United States—Colorado River. *B. American G.S.* **38** (1906): 1–16. **Macdougal.**

The Delta of the Rio Colorado. By D. T. Macdougal. *With Maps and Illustrations.*

See note in the Monthly Record, June number (p. 631).

United States—Geological Survey. **[Walcott.]**

Twenty-sixth Annual Report of the Director of the United States Geological Survey, 1904–5. Washington, 1905. Size 11½ × 8, pp. 322. *Maps.*

United States—Historical. **Lowery.**

The Spanish Settlements within the present limits of the United States, 1513–1561; Florida, 1562–1574. By Woodbury Lowery. New York and London: G. P. Putnam's Sons, 1901, 1905. Size 9½ × 6½, pp. xii. and 516, and xx. and 500. *Maps and Illustrations. Price* 21*s. net.*

The best history that has appeared on the early pioneer work of the Spanish in the United States.

United States—Historical. **Pittman and Hodder.**

The Present State of the European Settlements on the Mississippi, with a Geographical Description of that River illustrated by Plans and Draughts, by Captain Philip Pittman. An exact reprint of the original edition, London, 1770; edited, with Introduction, Notes, and Index, by Frank Heywood Hodder. Cleveland: The Arthur H. Clark Co., 1906. Size 9½ × 6½, pp. 166. *Facsimile Maps and Plans. Price* $3 *net.*

One of the many reprints of scarce works of travel, etc., which have appeared in America within the last few years. The author went out with the British troops sent to occupy and organize the portions of Louisiana ceded to England by the treaty of Paris, and his narrative is a valuable authority on occurrences during his five years' residence. All the original maps and plans are reproduced in facsimile.

CENTRAL AND SOUTH AMERICA.

Argentine Republic. **Martinez and Lewandowski.**

L'Argentine au XX^e^ Siècle. Par Albert B. Martinez et Maurice Lewandowski. Avec une Introduction par Charles Pellegrini. Paris: A. Colin, 1906. Size 7½ × 5, pp. xxxii. and 432. *Maps. Price* 5 *fr.*

A useful summary of facts concerning the Argentine, especial attention being devoted to economic resources.

Argentine Republic. *Deutsch. Rundschau G.* **28** (1906): 206–211. **Federicos.**

Die Quebracho-Waldungen in Argentinien und ihre Zukunft. Von G. L. Federicos.

Brazil and Columbia. *Z. Ges. E. Berlin* (1906): 80–101. **Koch.**

Bericht über seine Reisen am oberen Rio Negro und Yapurá in den Jahren 1903–1905. Von D. Theodor Koch-Grünberg. *With Map and Illustrations.*

Noticed in the May number (p. 505).

Central America and West Indies. **Sapper.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 102–134.
Ergebnisse der neueren Untersuchungen über die jüngsten mittelamerikanischen und westindischen Vulkanausbrüche. Von Prof. Dr. K. Sapper.

Colombia—Volcanoes. **Stübel and Wolf.**
Die Vulkanberge von Colombia, geologisch-topographisch aufgenommen und beschrieben von Alphons Stübel. Nach dessen Tode ergänzt und herausgegeben von Theodor Wolf. Dresden: W. Baensch, 1906. Size 13 × 10, pp. 154. *Maps and Plates. Price* 20*m*. *Presented by the Publisher.* [To be reviewed.]

Columbia—Earthquake. *Nature* **73** (1906): 395. ———
The Columbian Earthquake.

Panama. **Pensa.**
La République et le Canal de Panama. Par Henri Pensa. Paris: Hachette & Cie., 1906. Size 10 × 6½, pp. 344. *Maps. Price* 7 *fr.* 50. *Presented by the Author.*

Paraguay. **Mangels.**
Wirtschaftliche, naturgeschichtliche und Klimatologische Abhandlungen aus Paraguay. Von H. Mangels. München: Dr. F. P. Datterer & Cie., 1904. Size 9½ × 6, pp. viii. and 364. *Illustrations. Price* 5*s*. 3*d*.
A miscellaneous collection of studies largely bearing on the economic resources of Paraguay. They are of value in view of the scanty nature of the literature on that country.

West Indies. *T. Canadian I.* **7** (1902): 351–370. **Spencer.**
The Windward Islands of the West Indies. By J. W. Spencer. *With Maps and Illustrations.*

AUSTRALASIA AND PACIFIC ISLANDS.

Bering Sea—Seal Islands. **Stejneger.**
Norske G.S. Aarbog **16**, 1904–1905 (1905): 128–136.
Fra mine reiser til Sælǿerne i Beringshavet. Af Leonard Stejneger.

Hawaii. *Jahresb. G. Ges. Bern* **19**, 1903–4 (1905): 79–99. **Volz.**
Eine Reise auf den Sandwich-Inseln. Vortrag von Dr. Walter Volz.

New Guinea—Dutch. *Ts. K. Ned. Aard. G. Amsterdam* **23** (1906): 320–331. **Ruys.**
Bezoek aan den Kannibalenstam van Noord Nieuw-Guinea. Door Th. H. Ruys.

New Zealand. ———
Statistics of the Colony of New Zealand, 1904. 2 vols. Wellington, 1905. Size 13½ × 8½, pp. xvi. and 640.

Samoa—Eruption. *Deutsch. Koloniablatt* **17** (1906): 143. **Williams.**
Bericht des Amtmanns Williams über den Ausbruch des Vulkans auf Sawaii. *With Sketch-map.*

Samoa—Eruption. *Koloniale Z.* **7** (1906): 150–152. ———
Bericht über eine Reise nach Savaii zur Besichtigung des dortigen, im August 1905 entstandenen Vulkans. Von G. S.
Cf. note in the *Journal* for December, 1905, p. 675.

South Australia. **Gill.**
The History and Topography of Glen Osmond. By Thomas Gill. Adelaide, 1905. Size 9 × 6, pp. vi. and 162. *Illustrations.*

South Australia. **Gregory.**
The Dead Heart of Australia. A Journey around Lake Eyre in the Summer of 1901–1902, with some account of the Lake Eyre Basin and the Flowing Wells of Central Australia. By J. W. Gregory, F.R.S., D.SC. London: John Murray, 1906. Size 9 × 6, pp. xvi. and 384. *Maps and Illustrations. Price* 16*s*. *net. Presented by the Publisher.* [To be reviewed.]

POLAR REGIONS.

Antarctic. *M.G. Ges. München* **1** (1905): 491–494. **Drygalski.**
Die Antarktis. Von Prof. Dr. E. von Drygalski.

Antarctic—Flora. *C. Rd.* **142** (1906): 456–458. **Cardot.**
Note sur la végétation bryologique de l'Antarctide. Note de J. Cardot.

Antarctic—German Expedition. **Drygalski and Others.**
Verh. 15. *Deutsch. Geographentages Danzig* (1905): 3–64.

Allgemeiner Bericht über die Arbeiten der Deutschen Südpolar-Expedition und deren Verwertung. Von Prof. Dr. Erich von Drygalski. Einige zoogeographische Ergebnisse der Deutschen Südpolar-Expedition. Von Prof. Dr. E. Vanhöffen. Mitteilungen über das Vorkommen und die Tätigkeit der Bakterien im Meer. Von Dr. H. Gazert. Ueber Grundproben und geologisch-petrographische Arbeiten der Expedition. Von Dr. E. Philippi. Ueber die Windverhältnisse an der Winterstation des *Gauss*. Von Dr. Wilh. Meinardus. Erdmagnetische Probleme und die Deutsche Südpolar-Expedition. Von Dr. Fr. Bidlingmaier. Die erdmagnetischen Arbeiten auf der Kerguelen-Station. Von Dr. K. Luyken. *With Map and Diagrams.*

Antarctic—Wilkes Land. *B. American G.S.* **38** (1906): 30–32. **Balch.**

Wilkes Land. By E. S. Balch.

The writer contests the views of Captain Scott in regard to Wilkes Land.

Arctic—Russian Expedition. **Toll.**
B.A. Imp. Sc. St. Petersburg, Classe phys.-math. **18** (1903): 65–94; **20** (1904): 55–66, 149–194.

Rapports sur les travaux de l'expedition Polaire Russe dirigée par le Baron Toll; iv.–v.; vi.; vii.–ix. *With Map and Plates.* [In Russian.]

Polar Regions. **Arctowski.**

Projet d'une Exploration Systématique des Régions Polaires. Par Henryk Arctowski. Bruxelles, 1905. Size 9 × 6, pp. 26.

MATHEMATICAL GEOGRAPHY.

Latitude. *Riv. G. Italiana* **12** (1905): 509–515. **Loperfido.**

Misura della latitudine geografica col metodo dei passaggi in meridiano di stelle fondamentali. Nota del A. Loperfido.

Longitude Determinations. **Christie.**

Royal Observatory, Greenwich: Telegraphic Determinations of Longitude made in the years 1888 to 1902. Under the direction of Sir W. H. M. Christie, K.C.B., Astronomer-Royal, Edinburgh. London: Wyman & Sons, 1906. Size 13 × 10, pp. viii., 324, and 188. *Plans and Diagrams. Price* 15*s. Presented by the Astronomer-Royal.*

Orientation. *G.Z.* **12** (1906): 101–105. **Peucker.**

Möllers "Orientierung nach dem Schatten," Die Taschenuhr als Kompass. Von Karl Peucker. *With Illustrations. Also separate copy presented by the Author.*

Surveying. *C. Rd.* **142** (1906): 421–424. **Hatt.**

Détermination simultanée de deux points au moyen des constructions graphiques à grande échelle. Note de — Hatt.

Surveying. **Lea.**

Hydrographic Surveying: Methods, Tables, and Forms of Notes. By S. H. Lea. New York: The Engineering News Publishing Co., 1905. Size 9½ × 6½, pp. 172 and viii. *Chart and Illustrations. Price* 8*s. net. Presented by the Publishers.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Geological History. *Ymer* (1906): 93–101. **Thoroddsen.**

Endnu nogle Ord om Landbro-Hypotesen. Af Th. Thoroddsen.

On the question of a post-glacial land-connection between Europe and America.

Geology. *Riv. G. Italiana* **12** (1905): 542–552. **Dainelli.**

Le ultime idee intorno alle falde di ricoprimento. G. Dainelli.

Geology. **Chamberlin and Salisbury.**

Geology: Earth History. By Thomas C. Chamberlin and Rollin D. Salisbury. Vols. **2** and **3**. London: John Murray, 1906. Size 9 × 6, pp. (vol. **2**) xxvi. and 692; (vol. **3**) xii. and 624. *Maps and Illustrations. Price* (*each vol.*) 21*s. net. Presented by the Publisher.*

Geomorphology—Valley Formation. **Reusch.**

Norske G.S. Aarbog. **16**, 1904–1905 (1905): 71–75.

En liden dal under dannelse. Af dr. Hans Reusch. *With Illustrations.*

Geophysics. *B.S. Belge Géol.* **19** (1905): 204–215. **Simoens.**

A propos d'une récente tentative de comparaison entre la constitution interne de la Terre et celle de la Lune. Par G. Simoens.

Gravity. *An. S. Ci. Argentina* **60** (1905): 280–301. **Alessio.**

Relazione sulla determinazione della gravità relativa fra La Plata (Osservatorio) e Padova (Regio Osservatorio). Eseguita dal Dottore Alberto Alessio.

Hydrology—Springs. *Popular Sc. Monthly* **67** (1905): 673–683. **Hitchcock.**

Fresh-water Springs in the Ocean. By Prof. C. H. Hitchcock. *With Map and Illustrations.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Cocoa. *Monthly B. Int. Bureau Amer. Republ.* **22** (1906): 812–818. ——

World's Cocoa Crops and Consumption, 1901–1904.

Ethnology—Eskimo. *Norske G.S. Aarbog* **16**, 1904–1905 (1905): 42–54. **Rasmussen.**

En Folkevandring. Af Knud Rasmussen.

Historical—Drake's Voyage. **Evans.**

The Silver Medal or Map of Sir Francis Drake. By Sir John Evans. (Reprinted from the *Numismatic Chronicle*, Fourth Series, vol. 6.) London, 1906. Size $8\frac{1}{2} \times 5\frac{1}{2}$, pp. 14. *Plate. Presented by the Author.*

The writer makes use of Mr. Miller Christy's book and other descriptions of the medal.

Historical—Early Travels. **Purchas.**

Hakluytus Posthumus or Purchas His Pilgrimes. By Samuel Purchas, B.D. Vols. **11** and **12**. Glasgow: J. MacLehose & Sons, 1906. Size 9 × 6, pp. (vol. **11**) xvi. and 650; (vol. **12**) xviii. and 634. *Maps. Price* 12*s.* 6*d. net per vol. Presented by the Publishers.*

These volumes include travels to Russia and Eastern Asia from Rubruk to the Jesuits in China.

Historical—Magellan's Voyage. **Pigafetta and Robertson.**

Magellan's Voyage around the World, by Antonio Pigafetta. The original text of the Ambrosian MS., with English translation, notes, bibliography, and index, by James Alexander Robertson. 2 vols., and index. Cleveland, U.S.A.: The Arthur H. Clark Co., 1906. Size 10 × $6\frac{1}{2}$, pp. (vol. **1**) 274; (vol. **2**) 314; (index) 88. *Portrait, Facsimile-maps, and Illustrations. Price* 31*s.* 6*d. net.* [To be reviewed.]

History of Geology. **Geikie.**

The Founders of Geology. By Sir Archibald Geikie, F.R.S. Second Edition. London: Macmillan & Co., 1905. Size $9\frac{1}{2} \times 6$, pp. xii. and 486. *Price* 10*s. net. Presented by the Publishers.*

An extension of the lectures on the same subject published in 1897, supplying a masterly sketch of the foundation and development of geological science.

GENERAL.

British Empire—Census. ——

Census of the British Empire, 1901. Report with Summary and Detailed Tables for the several Colonies, etc., Area, Houses, and Population; also Population classified by Ages, condition as to Marriage, Occupations, Birthplaces, Religions, Degrees of Education, and Infirmities. London, 1906. Size 13 × $8\frac{1}{2}$, pp. lxiv. and 302. *Map. Price* 3*s.* 5*d. Presented.*

The total area is given as 11,908,378 square miles, and the population as 398,401,704 (about April 1, 1901). The estimate of area for African possessions seems of doubtful accuracy both in the aggregate and in its constituent parts, many of the figures being far in excess of Supan's (*Journal*, September, 1904, p. 351).

Educational. **L'Estrange.**

A Progressive Course of Comparative Geography on the Concentric System. By P. H. L'Estrange. London: G. Philip & Son, 1906. Size $11\frac{1}{2} \times 9$, pp. xii. and 148. *Maps and Illustrations. Presented by the Publishers.* [To be reviewed.]

Hints to Travellers. **Neumayer.**

Anleitung zu wissenschaftlichen Beobachtungen auf Reisen . . . herausgegeben von Dr. G. von Neumayer. 3 Aufl. 2 vols. Hanover: Dr. M. Jänecke, 1906. Size 9 × 6, pp. (vol. 1.) xxiv. and 842, (vol. 2) xvi. and 880. *Map and Illustrations. Price (vol. 1) 25m., (vol. 2) 24m. Presented by the Publisher.* [To be reviewed.]

Hints to Travellers. **Reeves.**

Hints to Travellers, Scientific and General. Edited for the Council of the Royal Geographical Society by E. A. Reeves. Ninth edition. 2 vols. Vol 1, Surveying and Practical Astronomy. Vol. 2, Meteorology, Photography, Geology, Natural History, Anthropology, Industry and Commerce, Archæology, Medical, etc. London: the Royal Geographical Society, 1906. Size 7 × 5, pp. (vol. 1) xii. and 470, (vol. 2) viii. and 286. *Maps, Diagrams, and Illustrations. Price 15s. net.*

The work has been largely re-written, especially vol. 1, which has been adapted by Mr. Reeves to modern requirements in the matter of more precise surveys.

Hints to Travellers. **Stewart.**

Active Service Pocket Book. By Lieut. Bertrand Stewart. London: Gale & Polden, 1906. Size 5½ × 4½, pp. xvi. and 426. *Illustrations. Presented by the Author.*

Contains many hints likely to be of use to travellers in general as well as military officers.

World. **Moncrieff.**

The World of To-day. By A. R. Hope Moncrieff. Vol. 5. London: The Gresham Publishing Co., 1906. Size 11 × 7½, pp. viii. and 266. *Maps and Illustrations. Price 8s. net. Presented by the Publishers.*

Year-Book. **Haack.**

Geographen-Kalender . . . herausgegeben von Dr. H. Haack. Vierter Jahrgang. 1906–1907. Gotha: Justus Perthes, 1906. Size 6½ × 4½, pp. xii. and 664. *Portrait and Maps.*

A new feature this year is the very complete directory of Societies and Public Institutions in any way concerning geography. The maps illustrate, as usual, the chief political events and explorations of the year.

Year-Book. **Keltie and Renwick.**

The Statesman's Year-Book, 1906. Edited by Dr. J. Scott Keltie, with the assistance of I. P. A. Renwick. London: Macmillan & Co., 1906. Size 7½ × 5, pp. lxiv. and 1604. *Maps and Diagram. Price 10s. 6d. net. Presented by the Publishers.*

There are considerable additions to the subject-matter in this edition, principally as regards the United States, as well as other important new features. The maps and diagrams, besides illustrating the leading events of the year as regards political geography, show in particular the main economic features of the United States, and the average tariffs of the countries of the world. An ethnological map of Russia, by M. Aitoff, is published by permission of MM. Colin & Co.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

England and Wales. **Ordnance Survey.**

ORDNANCE SURVEY OF ENGLAND AND WALES:—Sheets published by the Director-General of the Ordnance Survey, Southampton, from June 1 to 30, 1906.

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Europe—Central. **K. u. K. Militärgeographisches Institut.**

Hypsometrischen Uebersichtskarte von Mittel-Europa. Scale 1:750,000 or 1 inch to 11·8 stat. miles. Sheets: G-7, Banjaluka; G-8, Cattaro; H-7, Orsova; H-8, Skoplje. Vienna: K. u. K. Militärgeographisches Institut, [1906].

Europe—Central. **K. Preussische Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Bearbeitet in der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1: 300,000 or 1 inch to 4·7 stat. miles. Sheets: Berlin; Stralsund. Berlin: K. Preussische Landesaufnahme, 1905. *Price* 1.50 *mark each sheet.*

Iceland. **Thoroddsen.**

Geologische Karte von Island. Von Th. Thoroddsen. Scale 1:750,000 or 1 inch to 11·8 stat. miles. *Petermanns Mitteilungen,* Ergänzungsheft, Nr. 153, Tafel 2. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

A general geological map of Iceland to accompany the second part of Dr. Thoroddsen's account of the structure of the island forming Ergänzungsheft, Nr. 153 of *Petermanns Mitteilungen.*

Portugal. **Serviço do Estado Maior, Lisbon.**

Carta Itineraria de Portugal. Scale 1:250,000 or 1 inch to 3·9 stat. miles. Sheets 6–12. Lisbon: Serviço do Estado Maior, 1903–1905.

An outline map, without hills, showing roads and railways. By means of the

colours and symbols employed, it is possible to ascertain at a glance the style of road between two places, while figures indicate the distances. Telegraph and postal stations are also indicated. When complete the map will consist altogether of twelve sheets, of which seven are already published.

ASIA.

Dutch East Indies. **Stemfoort and Siethoff.**

Atlas der Nederlandsche Bezittingen in Oost-Indië, naar de nieuwe Cronnen samengesteld en aan de regeering opgedrägen door J. W. Stemfoort en J. J. ten Siethoff, Kapiteins van den Generalen staf van het Nederlandsch-Indisch leger. Gereproduceerd, op last van het Departement van Koloniën, aan de Topographische Inrichting te 's Gravenhage, onder leiding van den Directeur C. A. Eksteiu. Sheet 5 (new edition), Oost-Java. Scale 1: 500,000 or 1 inch to 7·9 stat. miles. The Hague: Topographische Inrichting, 1906.

Indian Government Surveys. **Surveyor-General of India.**

Indian Atlas, 1 inch to 4 miles. Sheets: 5 S.E., parts of districts Bannu and Dera Ismail Khan (Punjab), additions to 1905. 16 S.E., parts of districts Dera Ismail Khan, Dera Ghazi Khan, Mianwali, Montgomery, Shahpur, Muzaffargarh, and Jhang (Punjab), additions to 1900. 21 N.E., parts of Udaipur, Jodhpur and Sirohi (Rajputana Agency), and of Idar, Dauta, and Palanpur, Native States (Bombay Presidency), additions to 1902. 40 S.W., parts of districts Belgaum, Ratnagiri, and Satara, Native States of Kolhapur and Southern Maratha and Satara Agencies (Bombay Presidency), additions to 1903. 40 S.E., parts of districts Belgaum, Bijapur, Satara, and Sholapur, and States of Kolhapur and Southern Maratha and Satara Agencies (Bombay Presidency), 1905. 41 S.W., parts of districts Belgaum and Kanara, Savantvadi State, and Kolhapur and Southern Maratha Agency (Bombay Presidency), and of Goa (Portuguese Territory), 1905. 49 S.E., parts of districts Gurgaon and Delhi (Punjab), Meerut, Bulandshahr, Muttra, Aligarh, and Moradabad (U.P. of Agra and Oudh), additions to 1904. 50 N.E., parts of districts Agra, Aligarh, Etah, Muttra (U.P. of Agra and Oudh), and Gurgaon (Punjab), and States Alwar and Bharatpur (Rajputana Agency), additions to 1904. 90 N.W., parts of districts Mandla and Bilaspur (C.P.), States of Rewah (C.I. Agency) and Chang Bhakar (Bengal), additions to 1905.—India and adjacent countries, scale 1: 1,000,000. Sheets: 87, parts of the Andaman and Nicobar Islands, 1905. 92, parts of Assam, Burma, and China (Yun-nun Province), 1905. 95 and 96 (provisional issue), parts of Burma and Siam, 1905. 100 (provisional issue), parts of Tibet and China (Yunnan and Sechuan Provinces), 1905.—Mysore, 1 inch to 16 miles, additions to 1905.—Mysore and Coorg, 1 inch to 16 miles, additions to 1905.—Assam, 1 inch to 32 miles, additions and corrections to 1905.—Lalitpur subdivision, Jhansi District, 1 inch to 5 miles, 1905.—United Provinces of Agra and Oudh, 1 inch to 8 miles: Allahabad district, corrected to 1905; Fraukhabad district, corrected to 1905.—Bengal, 1 inch to 8 miles: Darjeeling district, corrected to 1901; Noakhali, corrected to 1903.—Map of the country 10 miles round Calcutta (Fort William), 1 inch to a mile, additions to railways to 1903.—Northern Frontier Survey, 1 inch to 4 miles. Sheets: 9 N.E., 14 N.W., S.W., S.E., 15 N.E., 21 S.W., 22 N.W., N.E., S.E., Tibet, Season 1904–05, 1905.—North-Western Trans-Frontier Survey, 1 inch to 2 miles. Sheets: (Third edition), 432, parts of Afghanistan, Mohmand Country, Dir and Swat Agency, and district Peshawar (N.W.F. Province). Seasons 1853–98, 1904. 459, parts of districts Dera Ghazi Khan, Mianwali, Muzaffargarh, and Derajat Frontier, Seasons 1884–85, 1887–88–96, additions to boundaries to 1903.—North-Eastern Frontier Survey, 1 inch to 4 miles. Sheets: 6 N.W., N.E., S.W., S.E., Tibet, Season 1904–05, 1905. 7 S.W., Tibet (Chumbi Valley only), Season 1904–05, 1905.—South-Western Asia, 1 inch to 4 miles. Sheet 73 S.E., part of Persia (Fars) 1905.—South-Western Asia Survey, 1 inch to 8 miles. Sheet (3rd edition) 73, parts of Persia and Arabia, 1905.—Assam Survey, 1 inch to a mile. Sheet 29, parts of districts Garo Hills, Kamrup and Khasi, and Jaintia Hills (Assam), Season 1866–69, additions and corrections to 1903, 1905.—Bengal Survey, 1 inch to a mile. Sheets: 186 (2nd edition), parts of district Singhbhum and Mayurbhanja State, Seasons 1859–61, 1863–64, 1905; 422 (preliminary edition) and 423, district Chittagong, Season 1888–93, 1904.—Hyderabad Survey, 1 inch to 2 miles. Sheets 100, 101, 124, and 125, part of Koyalkanda Circar (Nizam's Dominions), Seasons 1821, 1824, 1825, 1829, 1830, 1833, 1901.—Bombay Survey, 1 inch to a mile. Sheets: 121, parts of district Ahmedabad, Baroda State, and Mahi Kantha Agency, Season 1877–78, additions to railways to July, 1903, 1905. 155, parts of district Surat, Baroda State, and Rewa Kantha Agency, Seasons 1879–81, additions and corrections to

1899, 1905. 181, parts of the Panch Mahals district and of the Rewa Kantha Agency, Seasons 1882–83, 1883–84, additions to railways to March, 1904. 231, parts of districts Poona and Ahmednagar, Season 1878–79, additions and corrections to boundaries to December, 1904, 1905. 236, part of district Satara, Season 1876–77, additions to roads and railways to April, 1892, 1905. 337, parts of districts, Dharwar (Bombay), Shimoga and Chitaldroog (Mysore), Seasons 1882–83, 1893–94, corrected to October, 1903, 1905.—Burma Survey, 1 inch to a mile. Sheets: 163 (3rd edition), parts of districts Henzada, Prome, and Tharrawaddy, Seasons 1882–85, 1898–99, 1901–02, 1905. 543, part of district Mergui, Season 1891–92, additions to boundaries to 1905.—Central India and Rajputana Survey, 1 inch to a mile. Sheets: 213, parts of States Gwalior, Jhabua, Rajpur Ali, Jobat, and Indore (C.I. Agency), Season 1879–80, additions and corrections to 1903, 1905. 245, parts of States Gwalior and Dhar (C.I. Agency), Season 1878–79, additions and corrections to September 1903, 1905; 269, parts of States Gwalior, Indore (C.I. Agency), Udaipur, Jhalawar and Kotah (Rajputana Agency), Seasons 1873–79, additions and corrections to 1903, 1905; 300, parts of States Gwalior, Indore, Khilchipur and Tonk (C.I. Agency), Jhalawar and Kotah (Rajputana Agency), Season 1873–74, additions to 1905. 303, parts of States Gwalior, Indore, Dhar, and Dewas (C.I. Agency), Season 1877–78, additions and corrections to 1904, 1905. 388 (2nd edition), parts of States Gwalior and Khaniadhana (C.I. Agency), and district Jhansi (United Provinces), Seasons 1859–61, 1869–71, 1895–96, 1897, 1905; 390 (2nd edition), parts of Gwalior State (C.I. Agency), Saugor District (C.P.), and Jhansi District (U.P.), Seasons 1856–57, 1864–65, 1870–72, 1895–96, 1905. 401 (2nd edition), parts of districts Jalaun and Jhansi (U.P.), and States of Gwalior, Indore, and Datia (C.I. Agency), Seasons 1852–61, 1862–63, 1888–90, 1905; 402 (2nd edition), parts of Datia, Samthar, and Orchha States (Bundelkhand, C.I. Agency) and district Jhansi (U.P.), Seasons 1862–63, 1888–90, 1905.—Madras Survey, 1 inch to a mile. Sheets: 44, parts of districts Chitaldroog and Shimoga (Mysore), Season 1881–82, additions and corrections to 1904, 1905. 71, parts of districts Chitaldroog and Tumkur (Mysore) and Bellary (Madras), Season 1881–82, additions and corrections to 1903, 1905.—Punjab Survey, 1 inch to a mile. Sheets: 81 (2nd edition) parts of districts Peshawar and Kohat, Khyber Agency (N.W. Frontier Province), and Attock (Punjab), Seasons 1877–78, 1881–83, 1900, 1905. 96, part of district Multan, Season 1903–04, 1905. 97, parts of district Multan and Bahawalpur State, Season 1902–04, 1905. 174 (preliminary edition), part of district Montgomery (Bari Doab), Season 1902–03, 1905. 194 and 207 (preliminary edition), part of district Lahore (Rechna Doab), Season 1902–03, 1905. 222, parts of districts Lahore and Amritsar (Bari Doab), Season 1902–03, 1905. 306, district Kangra (Kullu subdivision), Seasons 1896–97, 1900–01, 1905.—Sind Survey, ½ inch to a mile. Sheets: 81, 82, 99, and 100, district Sukkur and Khairpur State, Season 1901–03, 1905. 83, 84, 101, and 102, Khairpur State, Season 1901–02, 1905; 112 and 113, district Sukkur, Season 1902–03, 1905.—Sind Survey, 1 inch to a mile. Sheets: 7, district Larkhana, Season 1901–02, 1905. 60, districts Larkhana and Sukkur and Khairpur State, Seasons 1892–93, 1900–01, 1905.—United Provinces Survey, 1 inch to a mile. Sheets: 41 (2nd edition), parts of States Gwalior, Khaniadhana, and Orchha (C.I. Agency), and district Jhansi (U.P. Agra and Oudh), Seasons 1856–57, 1868–70, 1888–90, 1895–96, 1905. 42, parts of States Gwalior and Khaniadhana (C.I. Agency) and district Jhansi (U.P.), Seasons 1859–61, 1869–71, 1895–96, 1897, 1905. 44, parts of Gwalior State (C.I. Agency), Saugor district (C.P.) and Jhansi district (U.P.), Seasons 1856–57, 1864–65, 1870–72, 1895–96, 1905. 56a (2nd edition), parts of districts Jalaun and Jhansi (U.P.), and States of Gwalior, Indore, and Datia (C.I. Agency), Seasons 1852–61, 1862–63, 1888–90, 1905. 57 (2nd edition), parts of Datia, Samthar and Orchha States (Bundelkhand, C.I. Agency), and district Jhansi (U.P.), Seasons 1862–63, 1888–90, 1905. 60 (preliminary edition), district Jhansi, Season 1895–97, 1904.—Assam. Index map showing scales of publication, scale 1 inch to 50 miles. *Presented by the Secretary of State for India through India Office.*

AFRICA.

Egypt. **Survey Department, Cairo.**

Map of Girga Town. Scale 1 : 1000 or 63·4 inches to a stat. mile. 6 sheets. Cairo: Survey Department, 1905. *Presented by the Director-General, Survey Department, Cairo.*

German East Africa. **Van der Burgt.**

Originalkarte der Route von Mwansa nach Uschirombo in Deutsch-Ostafrika, 1903. Von J. M. M. van der Burgt. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles.

Petermanns Mitteilungen, Jahrgang 1906, Tafel 10. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AMERICA.

Brazil. **International Bureau of the American Republics.**

Brazil from official and other sources. Prepared in the International Bureau of the American Republics; Williams C. Fox, Director. Scale 1:4,752,000 or 1 inch to 75 stat. miles. Washington: International Bureau of the American Republics, 1905. *Presented by the International Bureau of the American Republics.*

The commercial maps to which series this belongs accompany the reports published by the U.S. International Bureau of American Republics. They are all similar in style, and contain much useful information, specially concerning means of communication, navigability of rivers, mining districts, etc. The present is a general map of Brazil, printed in colours, with the special information shown by various clearly defined symbols. The extreme points to which the principal rivers are navigable are shown by letters, and in cases where the river is not navigable from its mouth, the point at which navigation begins is also shown. In appearance the map is decidedly rough, but the information contained is valuable.

Brazil—Minas Geraes. **Chrockatt de Sá and Thompson.**

Mappa do Estado de Minas Geraes contendo os do Rio de Janeiro, Espirito Santo e S. Paulo. Organisado por J. Chrockatt de Sá com a collaboração de Eduardo A. G. Thompson. Scale 1:1,000,000 or 1 inch to 15·8 stat. miles. Rio de Janeiro: Laemmert e Cia, [1905].

This map has been compiled from documents furnished by the Brazilian Ministries of the Interior, Marine and Agriculture, and Public Works, in addition to many other sources of information, including the various mining departments and officials of the country. Much of the area it represents is very imperfectly known, especially in the northern and western parts of the map, and a great many of the river courses and mountain ranges, as laid down, can only be taken as approximate. It is a large map, measuring 45 by 56 inches.

A special plan is given, as an inset, of the mining centre of Ouro-Preto.

Canada. **Dept. of the Interior, Ottawa.**

Sectional map of Canada. Scale 1:190,080 or 1 inch to 3 stat. miles. Sheet 23, Emerson, revised to January 16, 1906. Ottawa: Department of the Interior, Topographical Surveys Branch, 1906. *Presented by the Canadian Department of the Interior.*

Chile. **Petermanns Geographische Mitteilungen.**

Die Skyring- und Otway-Buchten an der Magalhães Strasse. Nach den Aufnahmen der Chilenischen Marine im Jahre 1904. Scale 1:750,000 or 1 inch to 11·8 stat. miles. *Petermanns Mitteilungen*, Jahrgang, 1906, Tafel 11. Gotha: Justus Perthes, 1906. *Presented by the Publisher.*

AUSTRALIA.

Queensland. **Surveyor-General, Queensland.**

Queensland. Scale 1:2,534,400 or 1 inch to 40 stat. miles. Brisbane: Survey Office, Department of Public Lands, 1906. *Presented by the Surveyor-General of Queensland.*

A general map of Queensland in black and white only, showing, amongst other information, main tracks and roads, railway and telegraph lines, Government artesian bores, Government banks, and pastoral stations.

GENERAL.

World. **Bartholomew.**

Atlas of the World's Commerce. A new series of maps, with descriptive text and diagrams, showing products, imports, commercial conditions, and economic statistics of the countries of the world. Compiled from the latest official returns at the Edinburgh Geographical Institute, and edited by J. G. Bartholomew, F.R.S.E., F.R.G.S. Part v. London: George Newnes Limited, [1906]. *Price 6d. net each part. Presented by the Publisher.*

This part contains the following plates of maps and diagrams, with the usual accompanying text: (113) Wool supply; (114, 115) Wool-growing countries; (116) Wool statistics; (129) Steel production; (130, 131) Coal-mining countries; (132) Coal supply. There is also the usual continuation of the list of commodities of commerce, which extends, in this case, from "gutta-percha" to "leather."

World. **Stieler.**

Neunten, von Grund aus neubearbeiteten und neugestochenen Auflage von Stielers Hand-Atlas. 100 Karten auf 200 Seiten mit 162 Nebenkarten in Kupferstich und einem alphabetischen Verzeichnis aller im Atlas vorkommenden Namen (ungefähr 240,000 Namen enthaltend) herausgegeben von Justus Perthes' Geographischer Anstalt in Gotha. Lieferungen 2–8. Gotha: Justus Perthes, 1906. *Price* 60 *pf. each part.*

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during May, 1906. *Presented by the Hydrographer, Admiralty.*

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3568 m	= 1·5	North sea, Germany:—Lister deep. 2*s.*
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1239 m	= 4·5	New Guinea, Hall sound. Vari Vari anchorage. Plan added:—Fyfe bay.

(*J. D. Potter, Agent.*)

Charts Cancelled

No.	Cancelled by	No.
2117 Germany. Kiel bay, Als sound.	New chart. Kiel bay	2117
1363 Africa, west coast. Sherbro island to Cape Mesurado. Plan on this sheet:—Cape Mount river.	New chart. Manna river to Junk river. Plans:—Cape Mount bay, Monrovia bay	2478
1364 Africa, west coast. Cape Mesurado to Baffu bay. Plan on this sheet:—Monrovia bay.		
1767 China, east coast. Amoy harbour and approaches.	New chart. Approaches to Amoy harbour	1767
1156 Plans on the north coast of China:—Cochran landing.	New chart. Tau Tsui head to Shitau bay	3554
2415 Japan. Approach to Nagasaki harbour. Plan on this sheet:—Approach to dry dock.	New chart. Nagasaki harbour. Plan:—Approach to Mitsubishi dockyard	2815
2815 Japan. Nagasaki harbour.		

Charts that have received Important Corrections.

No. 1872, North sea:—Calais to the river Schelde entrance. 1128, Sardinia:—Ports in Sardinia, Ports Conte and Alghero, Port Alghero, Port Torres, Gulf of Oristano, Arbatax road. 3119, Africa, north coast:—Alexandria harbour. 566, Iceland:—Eastern portion. 2978, Iceland:—Sigle fiord to Niardvig. 19, South America, east coast:—Santos harbour. 887, South America, Magellan strait:—English, Crooked, Long, and Sea reaches. 631, Chile:—Smyth channel from south entrance to Fortune bay. 704, Madagascar:—Nosi Shaba to Moramba bay,

including Narendri bay. 2577, Philippine islands:—Between St. Bernadino and Mindoro straits. 2987, Philippine islands:—San Pedro bay to Libukan islands, including Juanico strait. 2454, Philippine islands:—Northern portion of the island of Luzon, with Bashi and Balintang channels. 1477, New Guinea:—Jomard island to Yeina island, including Misima, Deboyne, and Renard islands. 2528, New Zealand, sheet iv.:—Poverty bay to Cape Palliser.

(*J. D. Potter, Agent.*)

Indian Ocean and Red Sea. **Meteorological Office.**

Pilot Chart of the Indian Ocean north of 15° S. lat. and Red Sea for July, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Atlantic and Mediterranean. **Meteorological Office.**

Pilot Chart of the North Atlantic and Mediterranean for July, 1906. London: Meteorological Office, 1906. *Price* 6*d*. *Presented by the Meteorological Office.*

North Pacific. **U.S. Hydrographic Office.**

Pilot Chart of the North Pacific Ocean for July, 1906. Washington: U.S. Hydrographic Office, 1906. *Presented by the U.S. Hydrographic Office.*

PHOTOGRAPHS.

Bombay Presidency. **Varley.**

Seven photographs of the Bombay Presidency, taken by F. J. Varley, Esq., M.A. *Presented by F. J. Varley, Esq., M.A.*

Further contributions to the Society's photographs of India by Mr. Varley, who has already presented many others. The views of the rock temples are worthy of special attention.

(1) Rock temple at Harischandagad, Ahmednagar district; (2) Peak of Harischandagad; (3) Temple on Western Ghats; (4) Forest scene in North Kanara; (5) Temple on the Godaveri, Nasik; (6) Rath or processional car; (7) Fort gates, Sendwa, Holkars' territory.

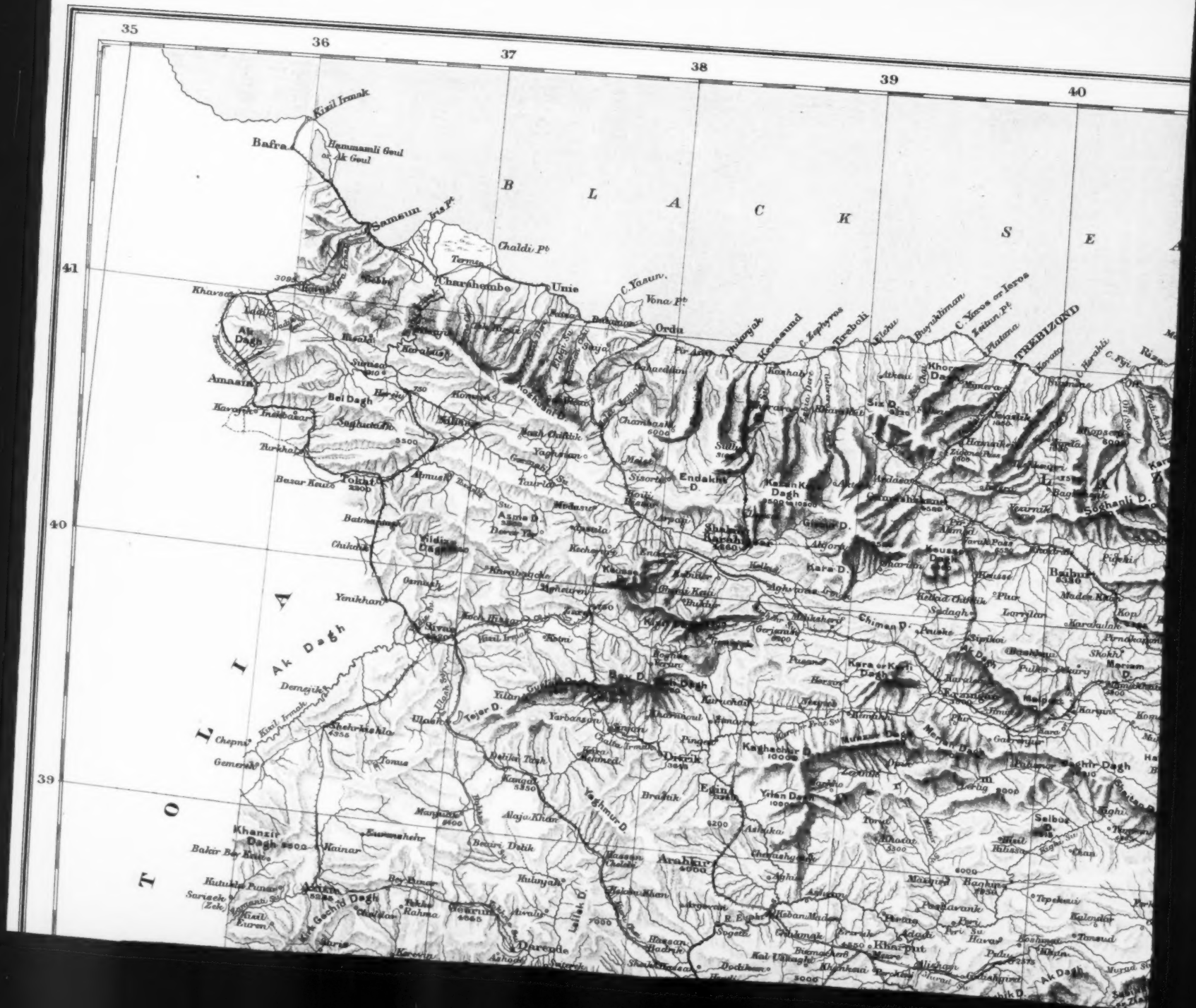
East Africa. **Behrens.**

Forty photographs taken by Lieut. T. T. Behrens, R.E., on the Anglo-German Boundary Survey in East Africa. *Presented by Lieut. T. T. Behrens, R.E.*

Lieut. Behrens was one of the British members of the Anglo-German Commission for delimiting the boundary between British and German East Africa. During his stay in the country he took many interesting photographs, copies of which he has presented to the Society. Some of them are extremely good, and the subjects are well selected.

(1) Panorama of Lake Jipe; (2) Lolgorossien mountains from Mbarai; (3) Mbarai and Lolgorossien mountains; (4) Transport donkeys, Mbarai; (5) Langara Loriga from foot of Kilimanjaro; (6) Ford, Tsavo river; (7) Source of the Tsavo river; (8) Tsavo river; (9) Dum palms and thorn bush, Tsavo river; (10) Ongelea hills; (11) Masai men and boys; (12) Young Masai men; (13) Masai children; (14–16) Fixing beehive to Baobab tree, Taveta; (17) Wateita porters; (18) Chala lake; (19) Rufu river; (20) Native garden in the Rufu swamp; (21) In the Pare hills; (22) Schagein in the Usambara hills; (23) Forest in the Usambara hills; (24) View from Schagein towards Jipe; (25) View east from Schagein; (26) Camp under the forest, north side of Kilimanjaro; (27) A typical grass fire; (28 and 29) Kilimanjaro from the north-west; (30) Kilimanjaro from the north; (31) Kilimanjaro from the north at sunset; (32) Oldonyu Rok; (33) Melawoni; (34) Kibo from Endoinet; (35) Kimawenzi from Endoinet; (36) Kilimanjaro from the north-east; (37) Kibo and Kimawenzi from the north-east; (38) Kibo and Kimawenzi from Naduyatui; (39) Kimawenzi and "Terminal" beacon from Laitokitok; (40) Kibo from Taveta.

N.B.—It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.


35
36
37
38
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40
41
B L A C K S E A
Kizil Irmak
Bafra
Hammamli Geul or Ak Geul
Samsun
Iris Pt.
Chaldi Pt.
Termia
Charshembe
Unie
C. Yasun.
Vona Pt.
Ordu
Khavsa
Ak Dagh
Amasia
Bel Dagh
Turkhal
Tokhat
Basar Kaiz
Batmanjik
Yildiz Dagh
Yenikhan
Sivas
Demerjikh
Kizil Irmak
Chepni
Gemerek
Tonus
Khanzir Dagh
Bakir Bey Euren
Kutukia Punar
Sarsack Zeki
Kirk Gechid Dagh
Darende
Kerevin
Hainar
Eumeshehr
Bey Bunar
Takas
Rahma
Kuluyak
Jaffak D.
Yaghmur D.
Alaja Khan
Beyuk Dehk
Manjanik
Tejar D.
Ulash
Yilan
Yarbanjyu
Kara D.
Kara or Kesh Dagh
Kaghachur D.
Drerik
Egin
Arabkir
Yilan Dagh
Ashuka
Chamashgerd
Aghin
Hassan Chelebi
Hekim Khan
Argovan
Hasan Hadrik
Sogatu
Kal Ushaghi
Shaikh Hadan
Dodikan
Khankani
Khar Put
Alishan
Ak Dagh
Murad Su
Tokat
Zile
Amasia
Endakht
Sisorta D.
Kazan Ka Dagh
Shakran Karahi
Gisser D.
Kara D.
Chiman D.
Kausse Dagh
Bulbura
Sughanli D.
Yazirnik
Kara or Kesh Dagh
Kara Dagh
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Kuzuldja
Kuzuldja Dagh
Yaghan
Sivrik
Kara Dagh
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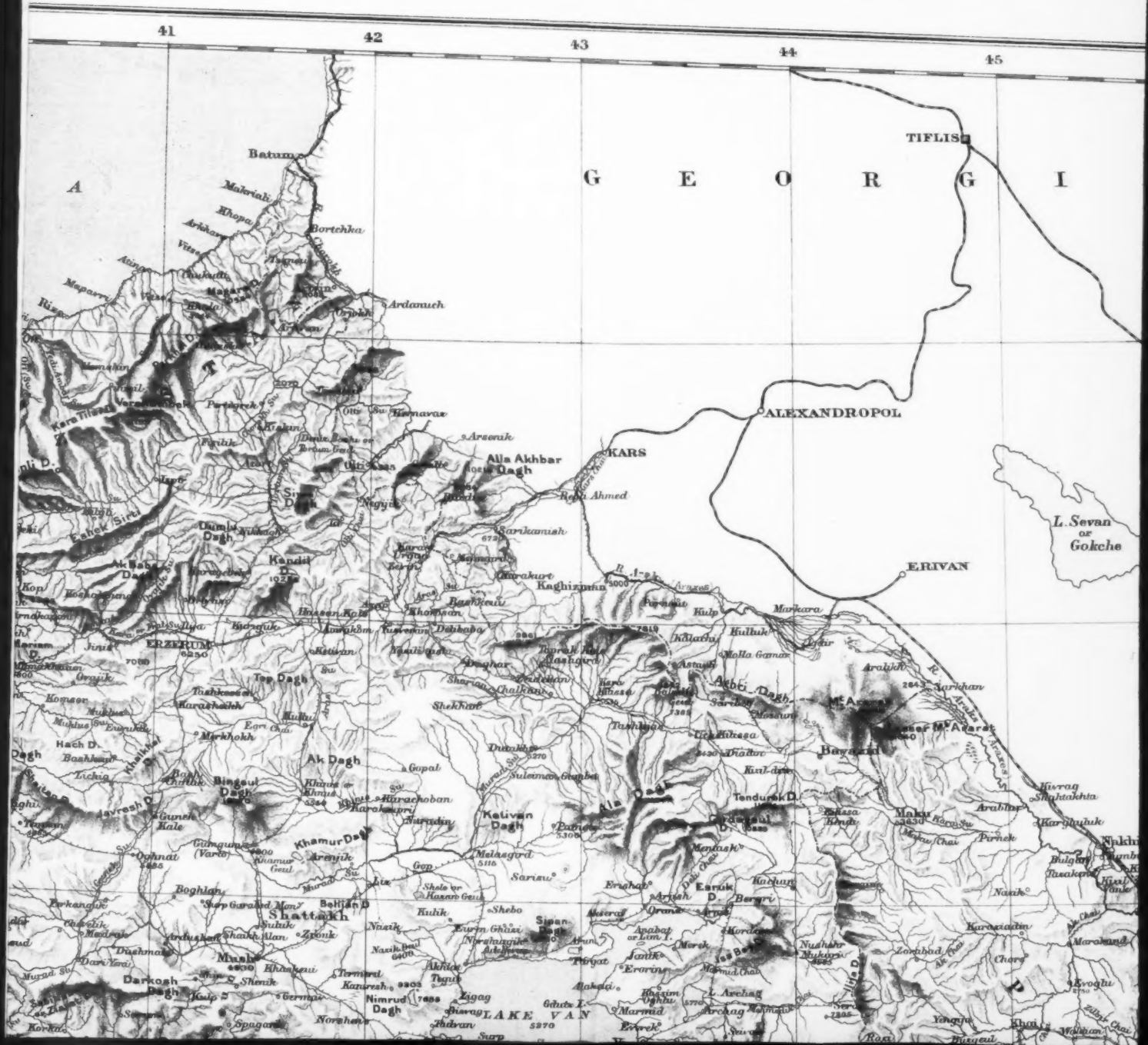
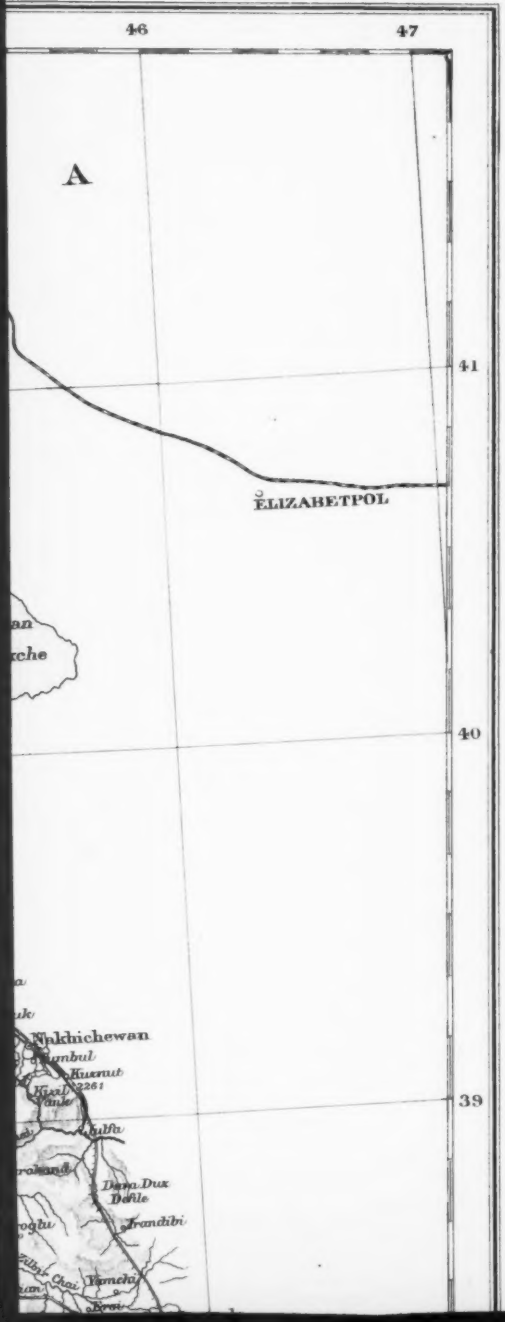
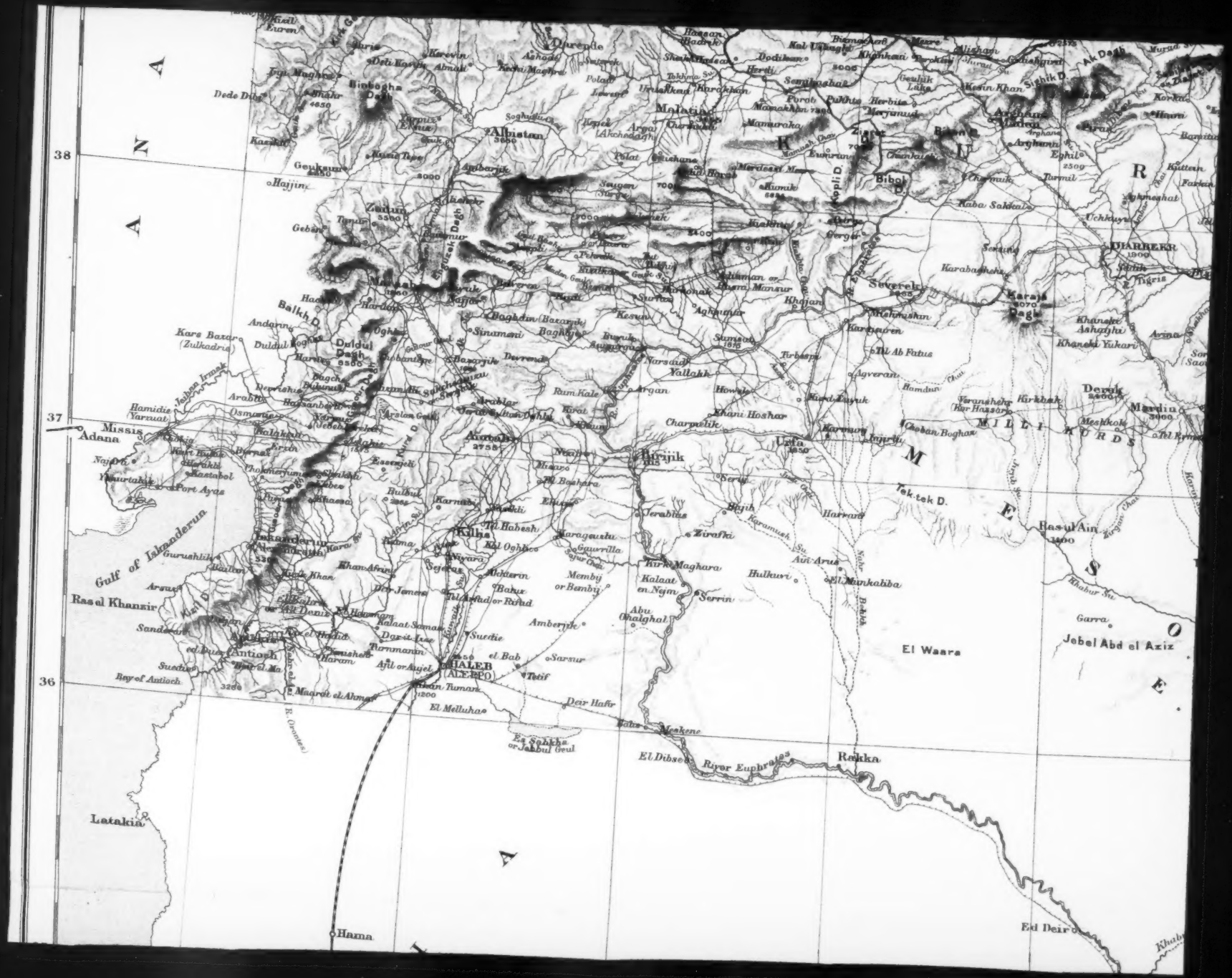

41
42
43
44
45
TIFLIS
G E O R G I
A
Batum
Bortchka
Ardanuch
ALEXANDROPOL
KARS
Alla Akhbar
Sirikamish
L. Sevan or Gokche
ERIVAN
ERZERUM
6250
Kandil D.
Dumlu Dagh
Top Dagh
Ak Dagh
Bingaul Dagh
Kelivan Dagh
Khamur Dagh
Shattakh
Darkosh Dagh
Nimrud Dagh
LAKE VAN
5270
Bayazid
Ala Dagh
Tendurek D.
Esruk D.
Aktchi D.
Aktchi
Mt. Ararat
Aghri Dagh
Sipan Dagh
Nushshar
Mukuru
Yengija
Khoi
Van

TURKEY IN ASIA

MAUNSELL

THE GEOGRAPHICAL JOURNAL 1906




38
37
36
Albistan
Zeitun
Marash
Duldul Dagh
Balkh D.
Kars Bazar
(Zulkadria)
Missis
Adana
Gulf of Iskanderun
Rasel Khanzir
Antioch
Bay of Antioch
Latakia
Hama
ALEPPO
HALEB
Kilis
Aintab
Membij
or Bembij
Jerablus
Zerafa
Serrin
Meskene
El Dibsee
River Euphrates
Rakka
El Waara
Jebel Abd el Aziz
Ed Deir
Derik
Mardin
Dirrikk
Ras ul Ain
Tek-tek D.
Sipkik D.
Bibok D.
Kopli D.
Ak Dagh
Karajak Dagh
Binbogha Dagh
Kurd Dagh
Jebel Akra
Gaza
Ezbeki
Sheikh Issa
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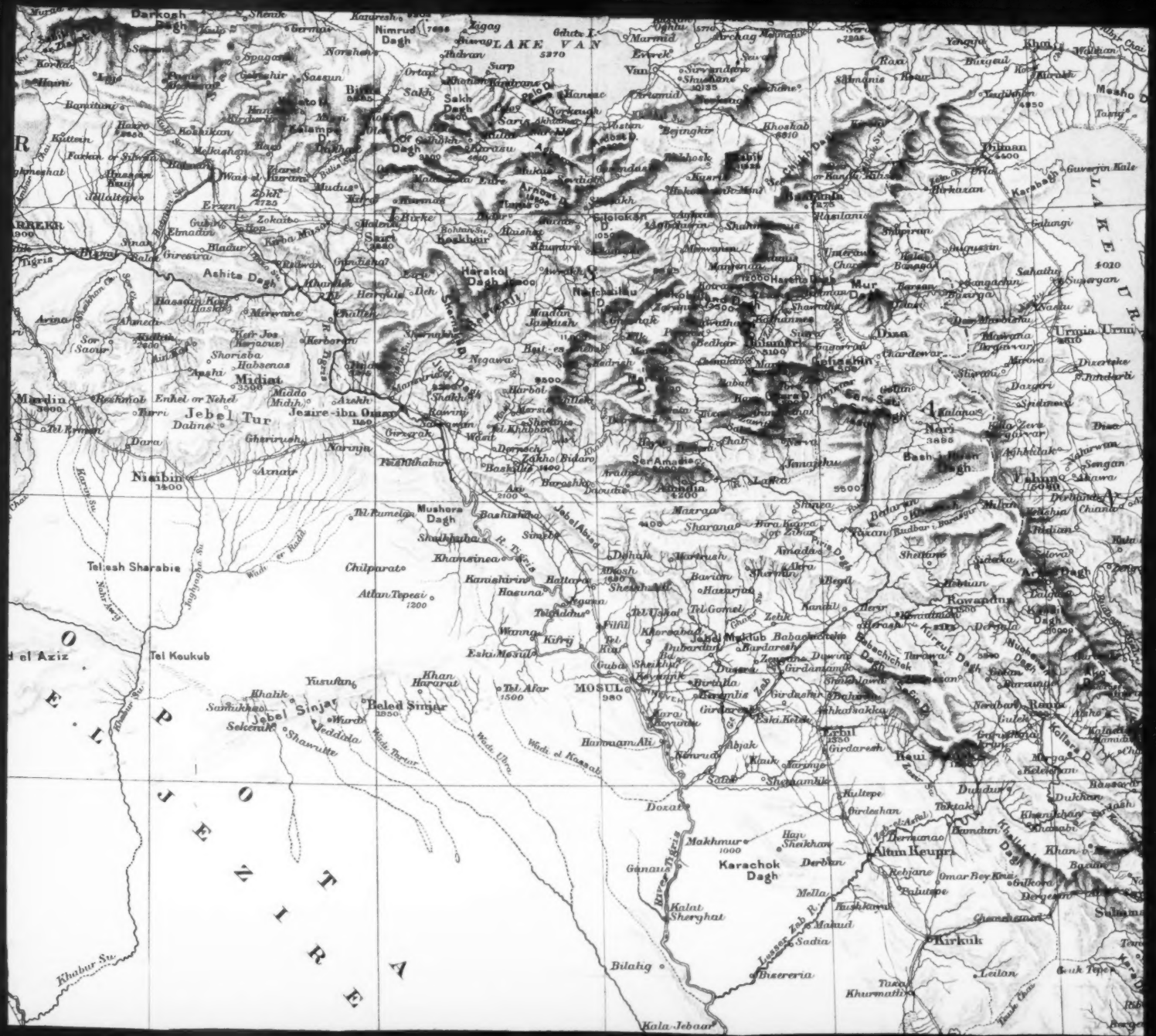
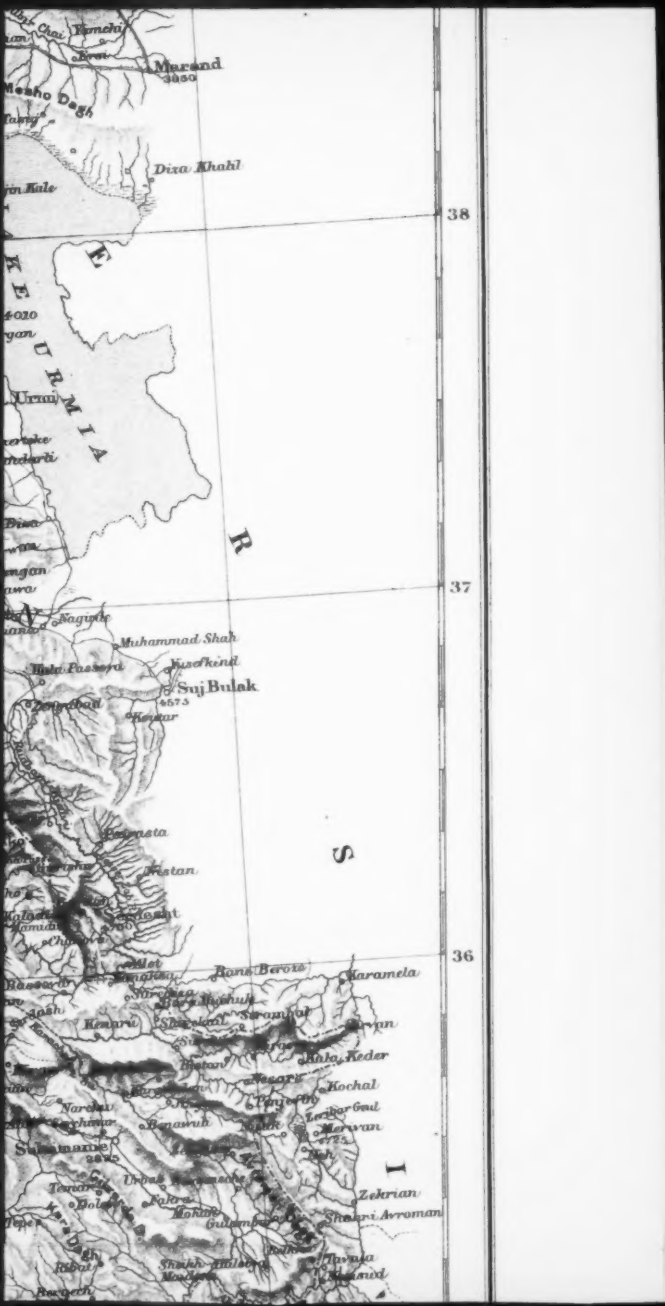
Tel Hamis
Tel Abiad
Tel Ahmar
Tel Habesh
Tel Bashara
Tel Ochbeo
Tel Ochbeo
Tel Ochbeo


LAKE VAN
LAKE URMI
MOSUL
Darkosh Dagh
Nimrud Dagh
Sakh Dagh
Harakol Dagh
Ashita Dagh
Karachok Dagh
Midiat
Jebel Tur
Jezire-ibn Omar
Nisibin
Mushora Dagh
Telesh Sharabie
Tel Koukub
Beled Sinjar
Jebel Sinjar
Tel Afar
Erbil
Kirkuk
Altun Keupri
Rowanduz
Urmia
Dizza
Sera Sati
Bash Hesan Dagh
Jebel Maklub
Jebel Abiad
Jebel Usdar
Jebel Gomel
Jebel Zebk
Jebel Hamrin
Jebel Makhmur
Jebel Sadia
Jebel Khurmatu
Jebel Leilan


Merand
3850
Mesho Dagh
Diza Khahl
38
37
Muhammad Shah
Yusefkend
Suj Bulak
4575
Kestar
Bostanta
Kistan
Baris Berose
Karamela
Kochal
Zekrian
Shekri Avroman
Tawsia
Hawand
Shaikh Hillaleh
Iskat
Resgeh
Sulaimanie
2850
Narshai
Banasrub
Marwan
4175
Tergever
Lower Gal
Kala Keder
Shekeban
Kemaru
Siramkal
Sirwan
Hesarik
Ushnu
Sakiz
Mahabad
Miandoab
Urmia
Nagadeh
Bukan
Pasawa
Chihriq
Dizaj
Ajabshir
Hamidan
Kamiran
Ushnuyeh
Dasht
Ajab
Shahi
Kuhsurkh
Ushnu
Sakiz
Mahabad
Miandoab
Urmia
Nagadeh
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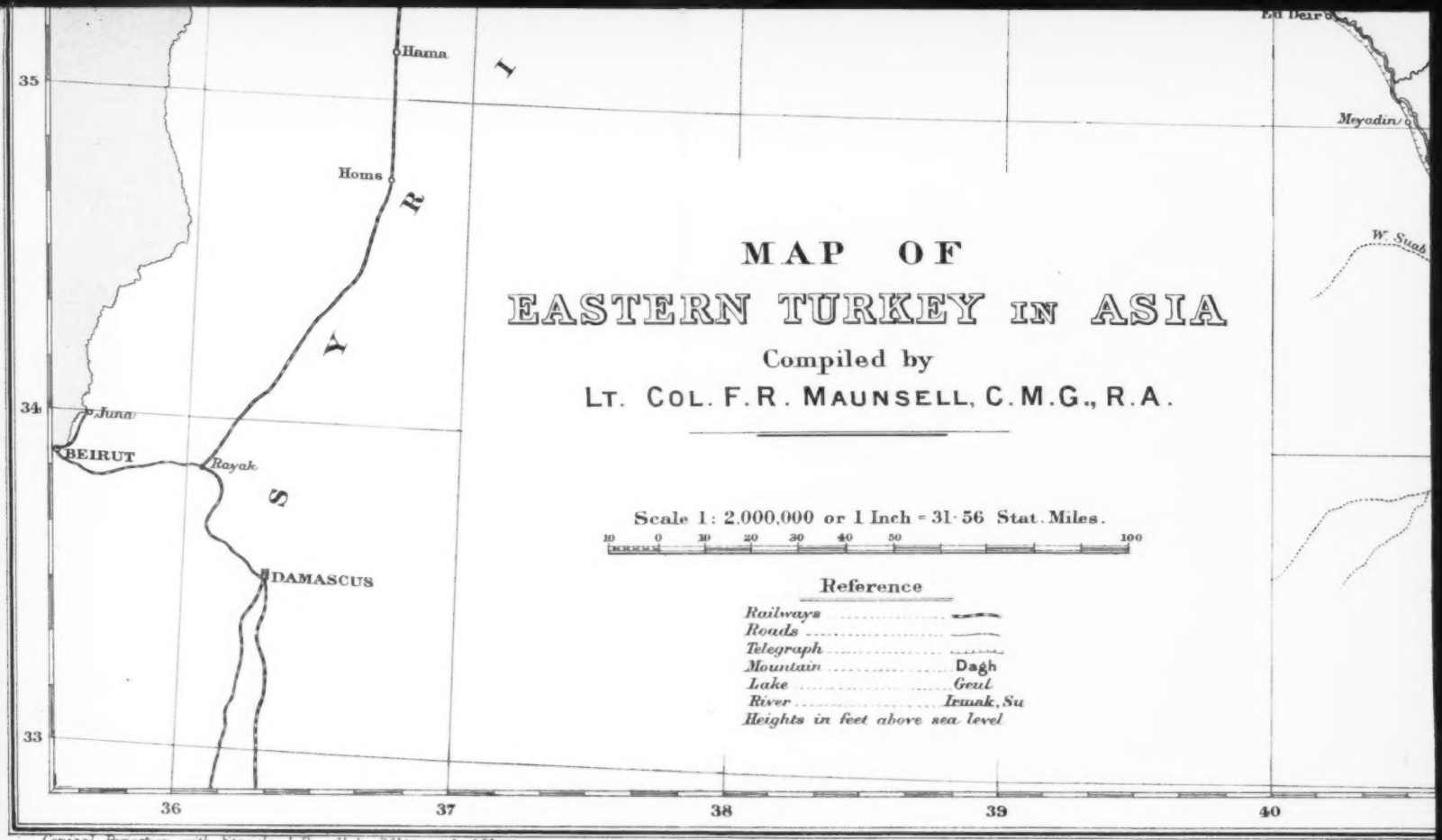
Dizaj
Ajabshir
Hamidan
Kamiran
Ushnuyeh
Dasht
Ajab
Shahi
Kuhsurkh



Conical Projection with Standard Parallels 34°20 and 40°40

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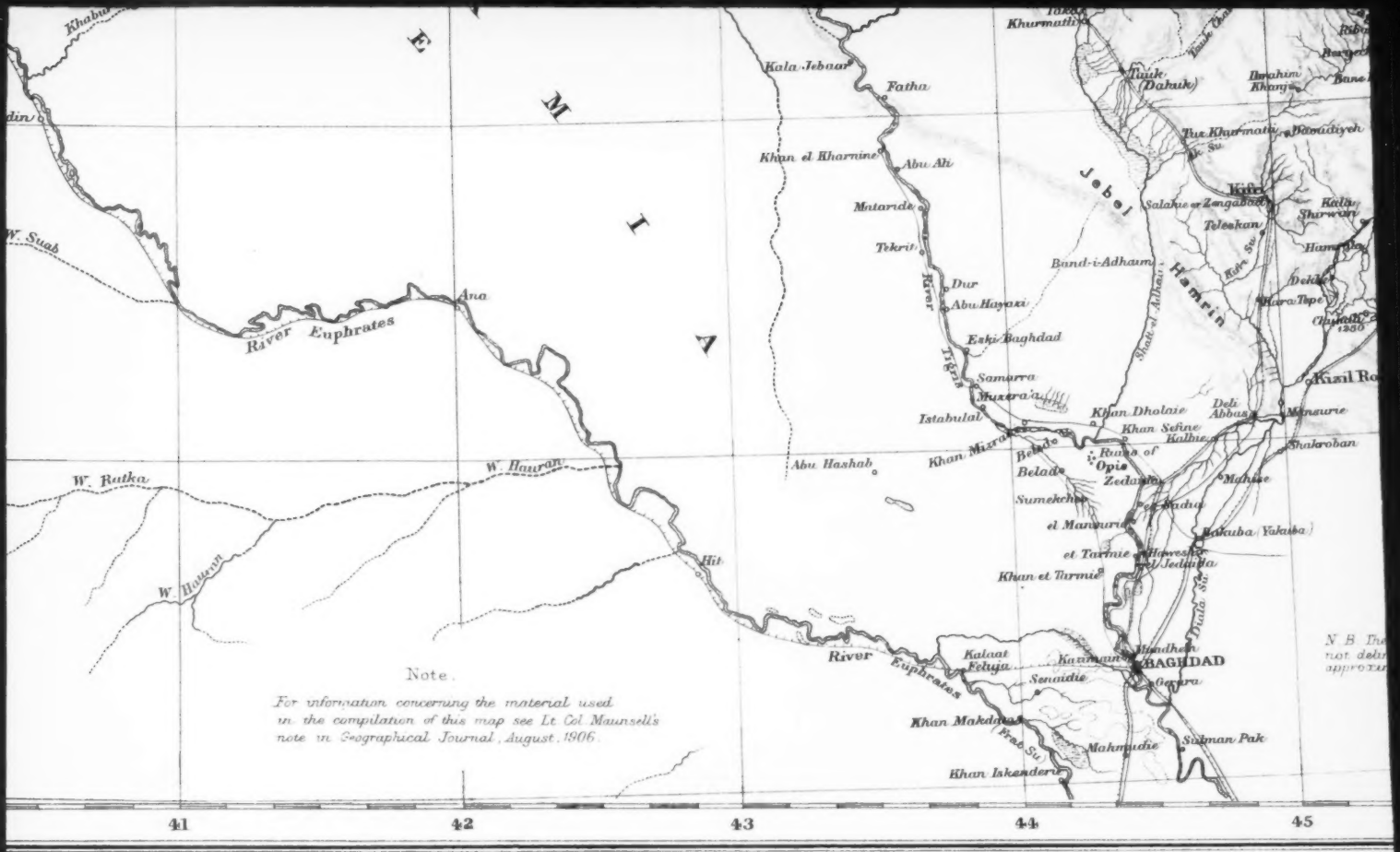

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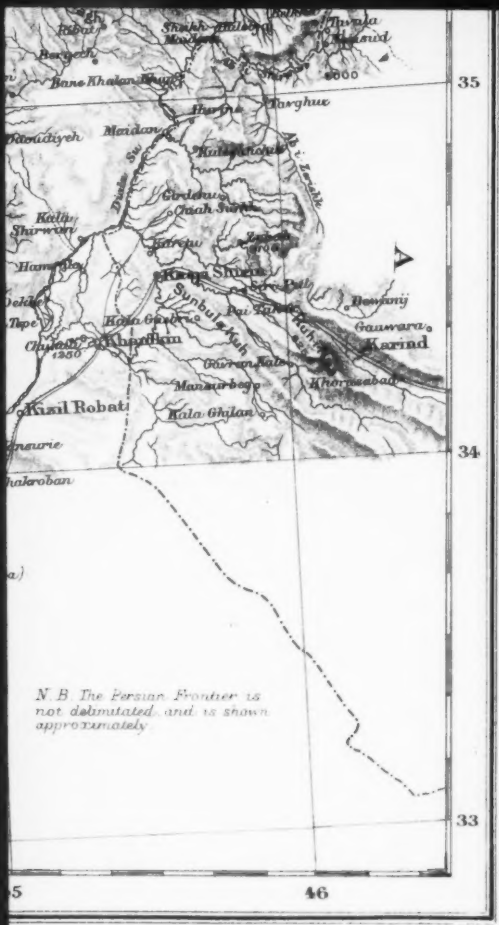
Ribat
Bagesh
Bane Khalan
Sheikh Mahdi
Targhur
Meidan
Kala Ghulam Ali
Kalu Sharwan
Hamsaya
Shiraz
Sarchu
Zeidi
Sar Pul
Sinbul Kuh
Pai Tal
Kala Gaduk
Chahar Khan
Gaurun Kala
Manzur-beyg
Kala Ghalan
Dehmuj
Gauwara
Karind
Khorramabad
Ahmadi
Kala Robati
35
34
33
46
N.B. The Persian Frontier is not delimitated, and is shown approximately.